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SOUTH DAKOTA STATE UNIVERSITY

WEST RIVER AG CENTER

CROPS AND SOILS RESEARCH

PLANT SCIENCE PAMPHLET #31

MARCH 2007

CELEBRATING 125 YEARS SDSU 1881-2006

INTRODUCTION

This is an annual progress report of the West River Crops and Soils Research Projects, South Dakota Agricultural Experiment Station. The equipment storage and processing facilities are located approximately one mile southwest of Box Elder, SD at 22735 Radar Hill Road. The office facilities are located at 1905 Plaza Boulevard; Rapid City, SD 57702. Telephone (605)394-2236, e-mail: Nleya.Thandiwe@ces.sdstate.edu, Rickertsen.John@ces sdstate edu or Swan.Bruce@ces.sdstate.edu

Internet web page: wrac.sdstate.edu

This publication can be found on the internet at: http://wrac.sdstate.edu/pubs/plant/plant.html

The Research Projects serve the western part of South Dakota. They are unique in that all experimental plots are cooperatively located with farmers. All the studies are located on farmer fields rather than at a particular experiment station. This allows for more mobility and localized data collection. This system is very dependent upon farmer cooperators and local extension agronomy educators.

This research tests the adaptability of new crops, varieties and farming methods. This report does not include results of work conducted by SDSU projects headquartered on campus at Brookings, South Dakota.

FIELD PLOT COOPERATORS

Name	Address	County
Larry Novotny	Martin 57551	Bennett
Bill Greenough	Oelrichs 57763	Fall River
Roger Rosenow	Ralph 57650	Harding
Henry Roghair	Okaton 57562	Jones
Merle Aamot	Kennebec 57544	Lyman
Kip Matkins	Sturgis 57785	Meade
Pat Brown	Scenic 57780	Pennington
Kent Kjerstad	Wall 57790	Pennington
Merritt Patterson & Sons	Wall 57790	Pennington
Crown Partnership	Wall 57790	Pennington
James Talty	Wall 57790	Pennington
Ron Seidel	Bison 57620	Perkins
David Neuharth	Hayes 57537	Stanley
Rex Haskins	Hayes 57537	Stanley
Mark Stiegelmeier	Selby 57472	Walworth

This is an annual report, some trials are ongoing and will require additional testing before final conclusions can be made.

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South Dakota State University, South Dakota Counties, and U.S. Department of Agriculture Cooperating

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ACKNOWLEDGMENTS

The following County Extension Educators assisted in locating cooperators and conducting the research: Sandy Huber-Martin, Mark Fanning-Hot Springs, TJ Swan-Belle Fourche, Mike Huber-Timber Lake, Robert Fanning-Kennebec, Ruth Beck-Ft. Pierre, Valerie Mitchell-Murdo, Justin Keyser –Burke, Dave Vander Vliet –Mound City and Robin Salverson – Buffalo.

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Research was conducted by Thandiwe Nleya – Assistant Professor, John R. Rickertsen-Research Associate II, and Bruce A. Swan-Senior Ag Research Technician, in conjunction with John D Kirby – Director Ag Experiment Station, Sue Blodgett – Dept. Head Plant Science, Bob Hall, Neal Foster, Jack Ingemansen, Amir Ibrahim, Martin Draper, Michael Moechnig, and Karl Glover.

A special thank you is extended to Stephanie Masters, Charlie Ellis and Michael Swan for their help during 2006.

This publication was written and edited by Thandiwe Nleya, John R. Rickertsen and Bruce A. Swan.

WEATHER SUMMARY

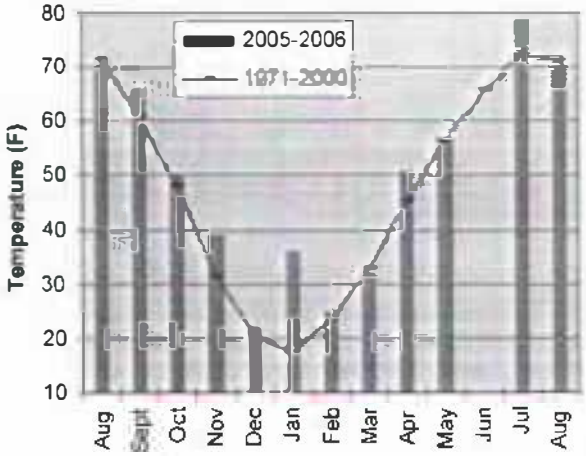
The data in the weather summaries presented in the following charts and table were obtained from the National Oceanic and Atmospheric Administration (NOAA) publication, Climatological Data – South Dakota; from Dennis Todey, State Climatologist at South Dakota State University; and from the South Dakota Crop-Weather Summary published by the South Dakota Statistical Reporting Service-USDA. Weather data were also collected at the weather station located at the Wall Rotation Study near Wall, South Dakota. For more information and data about South Dakota's climate, visit the website *climate.sdstate.edu*

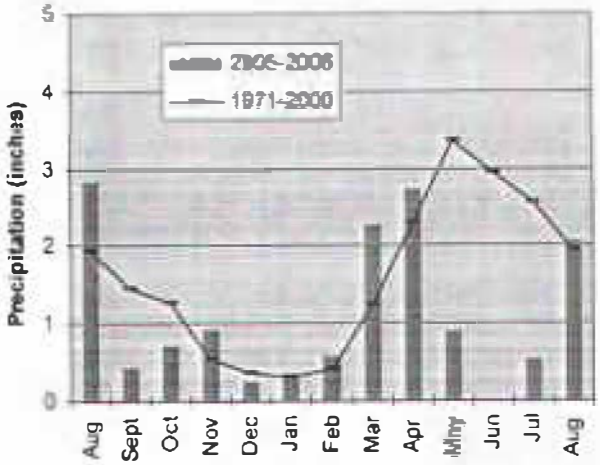
The drought conditions continued for the 2005-2006 growing season, especially for the central part of the state. Precipitation was near average for October through April and took a turn for the worse with limited rainfall in May, June and July. In August the rain started to come again with all locations average or above.

Temperatures in western South Dakota were mild for the winter of 2005 – 2006, with all months above average and January a remarkable 15 – 18 degrees above average. The spring and summer were hot with July being the hottest month on record for many locations. July was 7 – 8 degrees above the average with one day tying the record South Dakota high at 120 degrees. Conditions cooled in August as average temperatures returned to normal.

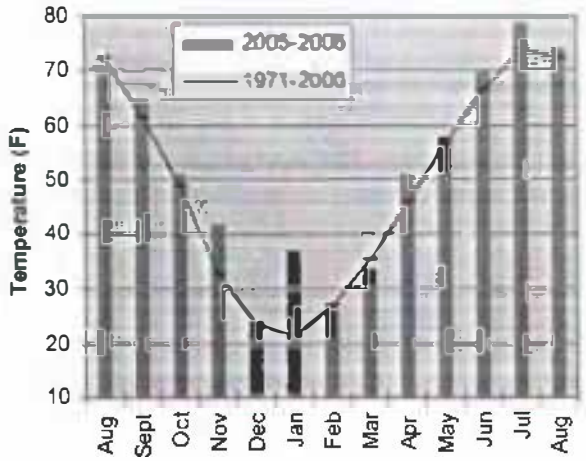
It was a poor year for most crops in western South Dakota, especially towards the Missouri River. The extreme heat and dry conditions along with the lack of stored soil moisture, made it tough for cool and warm season crops alike. The only crop that was decent was the sunflowers where there was good August precipitation.

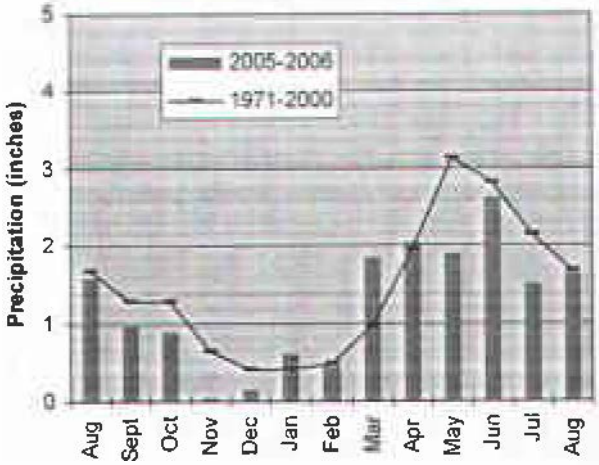
Temperature and Precipitation Charts for Martin (Bennett County Reporting Station).



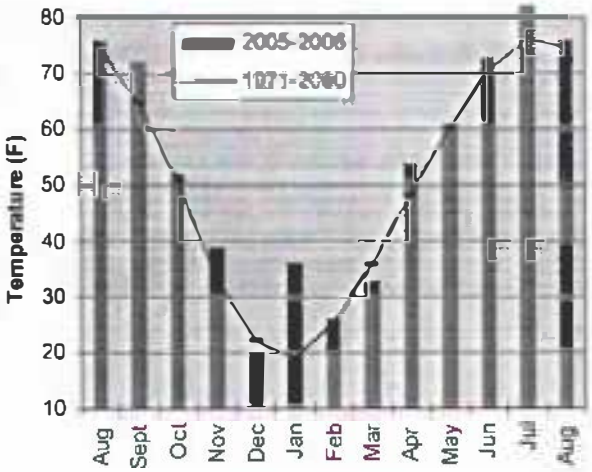


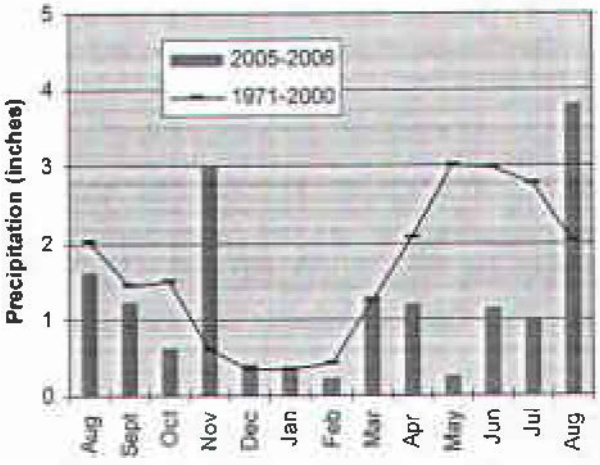
Temperature and Precipitation Charts for Oelrichs (Fall River County Reporting Station).





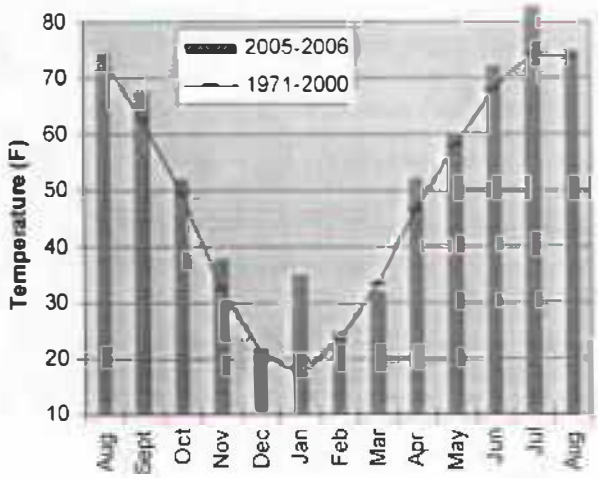
Temperature and Precipitation Charts for Kennebec (Lyman County Reporting Station).

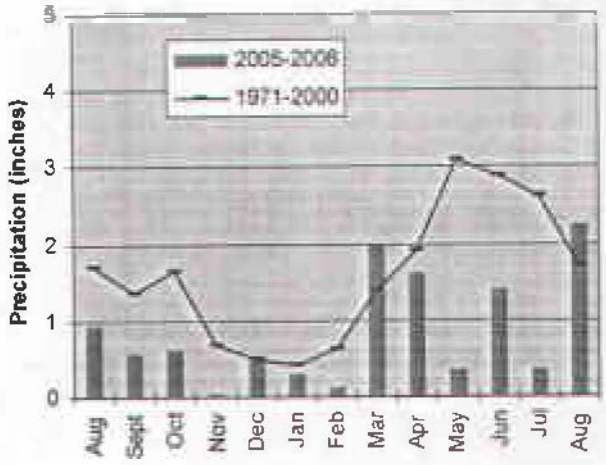




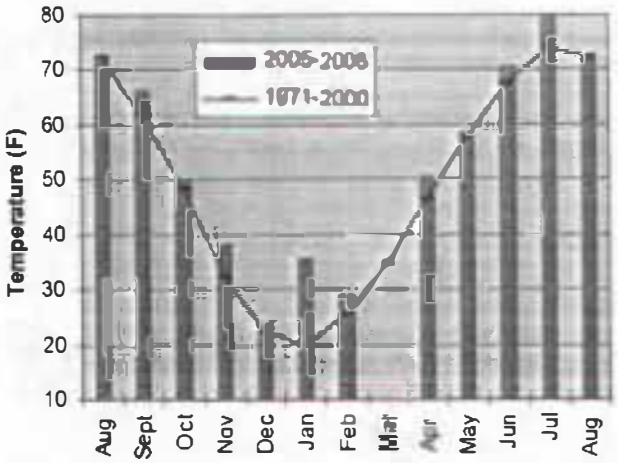
Average temperatures and precipitation obtained from NOAA Climatological Data. Weather data is collected from the reporting station nearest the experimental sites.

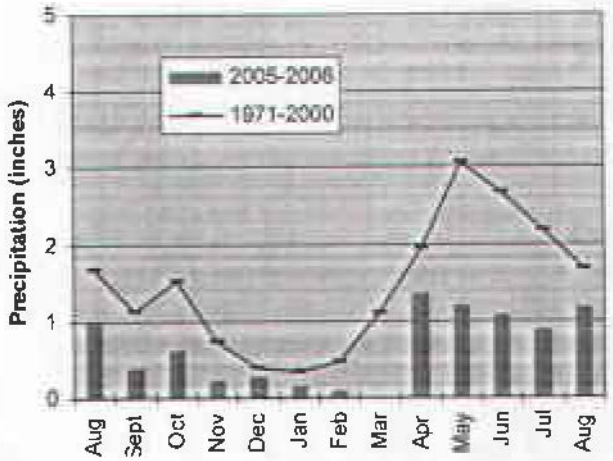
Temperature and Precipitation Charts for Kirley (Haakon County Reporting Station).



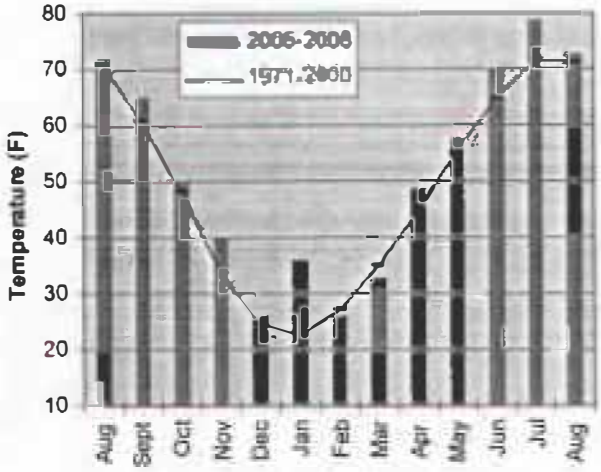


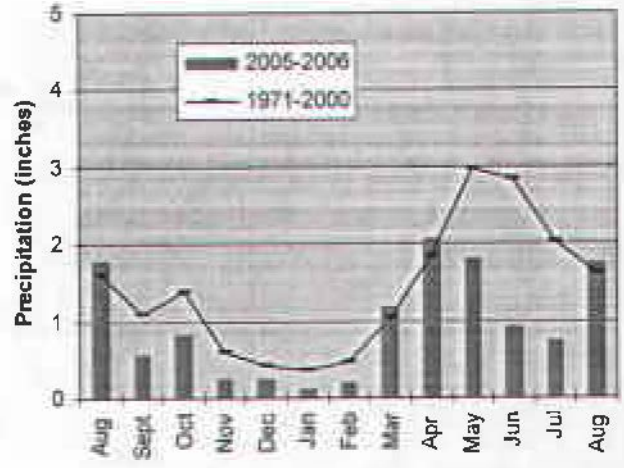
Temperature and Precipitation Charts for Wall (Rotation Study Site)





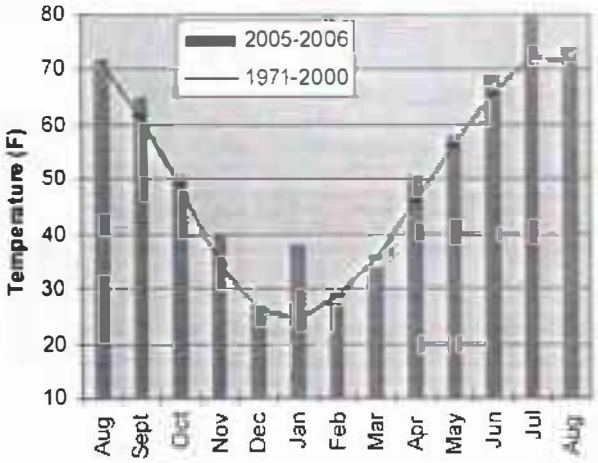
Temperature and Precipitation Charts for Rapid City Airport (Pennington County Reporting Station).

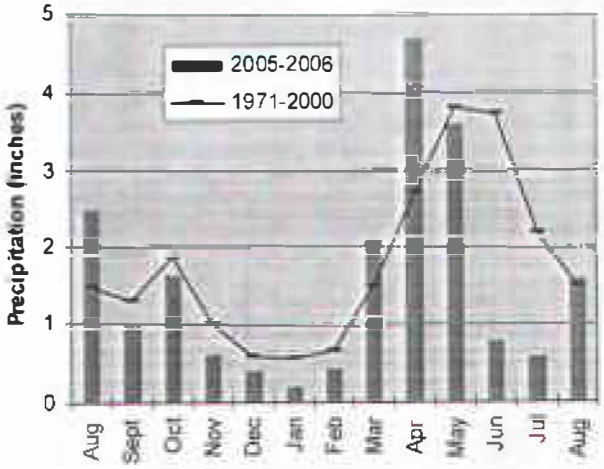




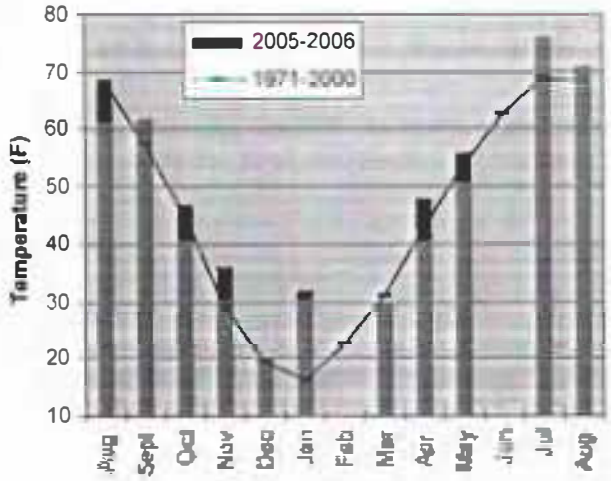
Average temperatures and precipitation obtained from NOAA Climatological Data. Weather data is collected from the reporting station nearest the experimental sites.

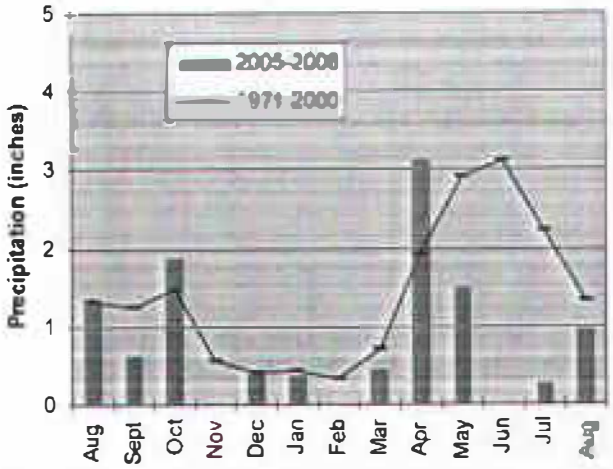
Temperature and Precipitation Charts for Ft. Meade (Meade County Reporting Station)



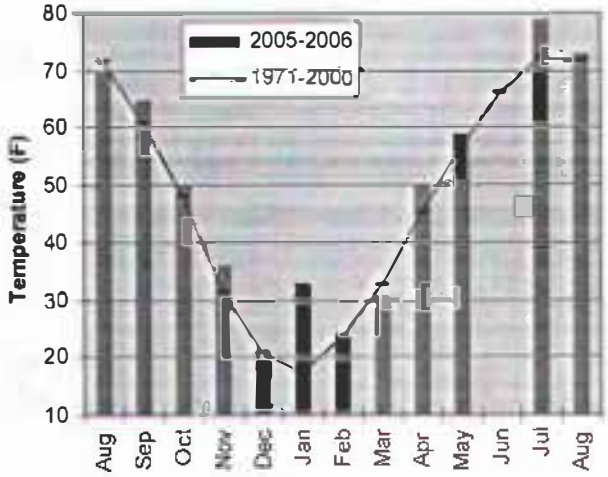


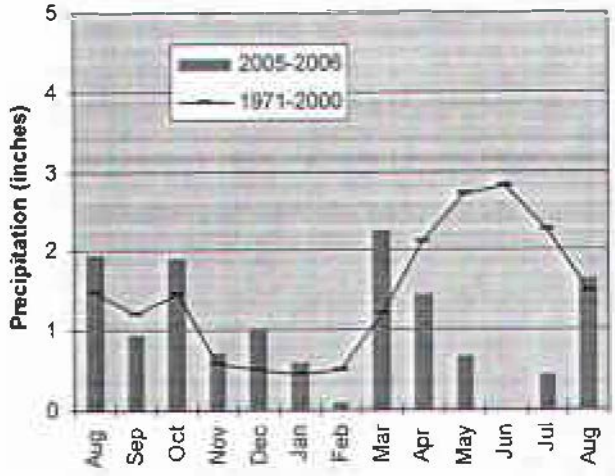
Temperature and Precipitation Charts for Ludlow (Harding County Reporting Station)





Temperature and Precipitation Charts for Bison (Perkins County Reporting Station).





Average temperatures and precipitation obtained from NOAA Climatological Data. Weather data is collected from the reporting station nearest the experimental sites

Table 1. Weather Data – Date of Critical Temperatures and Total Useable Precipitation in Counties with Experimental Plots (2005-2006).

Location	Date of Temperature*		Total	Total Useable Moisture**	
	First	Last	Moisture#	Aug. 05-July 06	April 06-July 06
Bennett County (Martin)	Oct 23, 2005 15 °F	May 10, 2006 28 °F	12.51" M	5.70" M	1.40" M
Fall River County (Oelrichs)	Oct 6, 2005 23 °F	April 16, 2006 21 °F	14.70"	7.78"	4.91"
Harding County (Ludlow)	Oct 5, 2005 28 °F	May 5, 2006 23 °F	10.04" M	6.14" M	3.71" M
Jones County (Murdo)	Oct 7, 2005 27 °F	April 26, 2006 26 °F	10.52" M	3.58" M	64' M
Meade County (Ft. Meade)	Oct 6, 2005 24 °F	May 5, 2006 27 °F	18.58" M	10.67" M	6.46"
Pennington County (Rapid City AP)	Oct 22, 2005 28 °F	May 5, 2006 27 °F	10.85"	4.85"	2.68"
Pennington County (Wall)	Oct 7, 2005 28 °F	Apr26, 2006 27 °F	7.37" M	2.00" M	1.43" M
Perkins County (Bison)	Oct 6, 2005 21 °F	May 5, 2006 26 °F	12.13" M	6.79" M	1.28" M
Haakon County (Kirley)	Oct 7, 2005 28 °F	Apr 19, 2006 28 °F	8.98" M	3.10" M	1.17"
Butte County (Newell)	Oct 6, 2005 25 °F	May 5, 2006 27 °F	13.07" M	6.36" M	4.27"
Lyman County (Kennebec)	Oct 7, 2005 25 °F	May 12, 2006 27 °F	12.44" M	5.51" M	.74" M

* = First 28° temperature in Fall or last 28° temperature in Spring, reported in degrees Fahrenheit.

** = Sum of all precipitation where amounts are in excess of .25 inch or totaled over .25 inch in two contiguous days.

= Total moisture from August 1, 2005 to July 31, 2006.

M = partial missing data from weather station site.

WINTER WHEAT VARIETY TRIALS

Objective: To evaluate standard and experimental hard red and hard white winter wheat varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Plots were seeded at seven locations in September 2006 with a John Deere 610 double disk (conventional fallow) or John Deere 750 (no-till) plot drills with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 950,000 seeds per acre (60 Lb/A). The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Herbicides were applied in either the fall or spring and varied according to weeds present. Visual stand ratings were taken in October 2005 and April 2006. The plots were trimmed to 5' x 25' after heading. The wheat was harvested in July with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest. Protein content was determined with a Near Infrared Spectrophotometer (Technicon InfraAlyzer 400).

Location Summaries:

Locations not Harvested

Location	Reason
Perkins County – Bison	Drought
Stanley County – Hayes	Drought
Lyman County – Kennebec	Drought

Fall River County – Oelrichs

Planted: September 21, 2005 Herbicide: Glean ($^1/_3$ oz/A)
Harvested: July 11, 2006 Additional Nitrogen: 80 lb/A
Previous crop: Conventional fallow

Yields at Oelrichs were decent in 2006 averaging 53 Bu/A. The top yielding varieties in 2006 were Hatcher, Wahoo, Harry, NuDakota, Jagalene, NuFrontier and Expedition. There are no three year averages for Oelrichs. Results are presented in Table 2.

Bennett County – Martin

Planted: September 23, 2005 Herbicide: Harmony GT ($^1/_2$ oz/A)
Harvested: July 12, 2006 Additional Nitrogen: 80 lb/A
Previous crop: Barley stubble, no-till planted

Martin had good yields in 2006 considering the dry conditions with an average yield of 44 Bu/A on recrop ground. The top yielding varieties in 2006 were Hatcher, Trego, Darrell, NuDakota, Wendy and Alice. There are no three year averages for Martin. Results are presented in Table 3.

Table 2. Hard Winter Wheat Variety Trial – Fall River County (Oelrichs), 2006

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Protein Percent	Yield Bu/A
Hard Red					
ALLIANCE	28	0	57.1	9.6	53.7
ARAPAHOE	31	0	59.1	11.4	51.4
CRIMSON	30	0	62.7	10.9	50.2
EXPEDITION	30	0	57.4	10.6	**56.1**
HARDING	31	0	59.9	11.5	51.5
HARRY	31	0	57.2	9.7	**59.2**
HATCHER	29	0	60.4	9.7	**61.4**
JAGALENE	31	0	61.3	10.4	**57.0**
JERRY	31	0	60.5	11.2	52.4
MILLENNIUM	30	0	59.8	11.5	55.4
NEKOTA	28	0	60.0	11.2	50.2
OVERLEY	31	0	58.0	11.2	54.0
TANDEM	31	0	60.9	11.3	50.8
WAHOO	29	0	58.5	10.6	**60.7**
WESLEY	28	0	56.3	11.3	50.5
NE01643	29	0	57.8	11.7	51.7
SD96240-3-1	28	0	57.8	11.9	44.6
SD97059-2	29	0	58.6	11.0	46.0
DARRELL	30	0	60.6	11.0	54.9
SD01058	31	0	59.8	10.5	54.8
SD01122	30	0	60.9	10.8	51.5
SD02279	31	0	60.5	11.7	50.9
SD02480	27	0	61.1	11.2	51.7
Hard White					
NUDAKOTA	27	0	57.9	10.2	**57.3**
NUFRONTIER	29	0	61.3	10.6	**56.4**
TREGO	27	0	60.4	10.3	53.4
WENDY	26	0	58.5	10.7	48.7
ALICE	27	0	58.7	10.8	52.1
SD98W175-1	28	0	61.6	10.4	55.1
SD01W064	30	0	60.8	10.1	49.7
Average	29.1	0.0	59.5	10.8	53.1
LSD (P=.05)	3.1	0.0	1.5		5.8
CV	5.2	0.0	1.8		7.8

* 0=No lodging, 9 = 100% lodged.

Table 3. Hard Winter Wheat Variety Trial - Bennett County (Martin), 2006.

Variety	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Protein Percent	Yield Bu/A
Hard Red					
ALLIANCE	25	0	58.7	11.1	40.5
ARAPAHOE	28	0	59.8	11.9	43.8
CRIMSON	29	0	60.7	12.7	40.8
EXPEDITION	26	0	60.5	11.1	42.9
HARDING	29	0	60.4	12.6	38.8
HARRY	27	0	57.0	10.5	42.6
HATCHER	26	0	60.8	11.0	**54.2**
JAGALENE	26	0	61.8	12.8	41.5
JERRY	27	0	60.6	12.2	41.5
MILLENNIUM	29	0	61.9	11.5	42.5
NEKOTA	25	0	60.0	12.7	40.6
OVERLEY	27	0	61.5	13.5	40.5
TANDEM	28	0	61.0	12.0	42.9
WAHOO	27	0	58.6	11.0	43.7
WESLEY	25	0	58.6	12.5	46.2
NE01643	28	0	60.5	11.7	43.2
SD96240-3-1	26	0	60.3	12.3	40.2
SD97059-2	28	0	60.0	12.3	44.0
DARRELL	29	0	61.6	11.9	**50.7**
SD01058	27	0	61.4	11.3	**49.4**
SD01122	28	0	60.5	12.0	43.8
SD02279	29	0	61.8	13.2	41.1
SD02480	27	0	63.2	13.0	41.5
Hard White					
NUDAKOTA	25	0	59.4	11.1	**48.6**
NUFRONTIER	28	0	61.3	11.7	45.5
TREGO	26	0	59.0	11.5	**51.9**
WENDY	25	0	62.8	11.2	**47.1**
ALICE	25	0	62.8	12.4	**46.2**
SD98W175-1	27	0	63.7	11.6	**46.5**
SD01W064	29	0	63.0	12.8	45.2
Average	26.8	0.0	60.8	12.0	44.3
LSD (P=.05)	2.5	0.0	1.7		7.9
CV	6.7	0.0	2.0		12.7

* 0=No lodging, 9 = 100% lodged.

Pennington County - Wall

Planted: September 15, 2005 Herbicide: None
Harvested: July 15, 2006 Additional Nitrogen: 80 lb/A
Previous crop: Chemical fallow, no-till planted

There was limited moisture at Wall in 2006 which led to average yield of 44 Bu/A. There was little difference in yields among varieties with most of them being in the top yield group. The best three-year average yields at Wall were from Wahoo, Jerry, Millennium, Darrell, Harding and Alliance. The results are presented in Table 4.

Meade County - Sturgis

Planted: September 19, 2005 Herbicide: Maverick ($^2/_3$ oz/A)
Harvested: July 19, 2006 Additional Nitrogen: 50 lb/A
Previous crop: Chemical fallow, no-till planted

Dry conditions continued at Sturgis in 2006 with limited growing season moisture limiting yields to 32 Bu/A. The top varieties in 2006 were Darrell, Hatcher, Jagalene, Alice, Wahoo, Harry and Trego. The top varieties over the past three years were Millennium, Darrell, Trego, Jagalene and Wahoo. The results are presented in Table 5.

Table 4 Hard Winter Wheat Variety Trial - Pennington County (Wall), 2004-2006.

Variety	Height	Lodging	Test Wt	Protein	Yield Bu/A	
	Inches	0-9*	Lb/Bu	Percent	2006	3-Year
Hard Red						
ALLIANCE	24	0	59	14.3	**46**	**48**
ARAPAHOE	25	0	60	13.5	**43**	43
CRIMSON	26	0	59	14.5	35	44
EXPEDITION	23	0	60	14.3	**46**	45
HARDING	28	0	60	14.6	**43**	**49**
HARRY	23	0	58	14.0	**46**	--
HATCHER	21	0	61	14.1	**40**	--
JAGALENE	20	0	62	14.9	**42**	**47**
JERRY	25	0	60	14.5	**40**	**50**
MILLENNIUM	24	0	61	13.8	**42**	**49**
NEKOTA	17	0	59	14.7	34	42
OVERLEY	23	0	61	14.9	**47**	--
TANDEM	26	0	62	12.0	**44**	**46**
WAHOO	25	0	59	14.2	**47**	**53**
WESLEY	21	0	58	13.8	**45**	45
NE01643	29	0	61	13.8	**45**	--
SD96240-3-1	24	0	60	15.2	**46**	--
SD97059-2	27	0	61	14.4	**45**	**50**
DARRELL	29	0	61	14.7	**41**	**49**
SD01058	31	0	61	13.8	**44**	--
SD01122	29	0	62	13.8	**44**	--
SD02279	28	0	61	13.8	**49**	--
SD02480	23	0	61	15.4	**45**	--
Hard White						
NUDAKOTA	22	0	58	13.7	**47**	--
NUFRONTIER	24	0	61	14.8	**46**	--
TREGO	18	0	61	13.7	**40**	42
WENDY	21	0	61	15.0	**47**	**46**
ALICE	21	0	61	14.0	**46**	45
SD98W175-1	25	0	62	13.9	**43**	--
SD01W064	26	0	63	15.1	**45**	--
Average	24	0.0	60	14.2	44	47
LSD (P=.05)	--	--	2	--	9	7
CV	--	--	2	--	12	12

* 0=No lodging, 9 = 100% lodged.

Table 5. Hard Winter Wheat Variety Trial - Meade County (Sturgis), 2006.

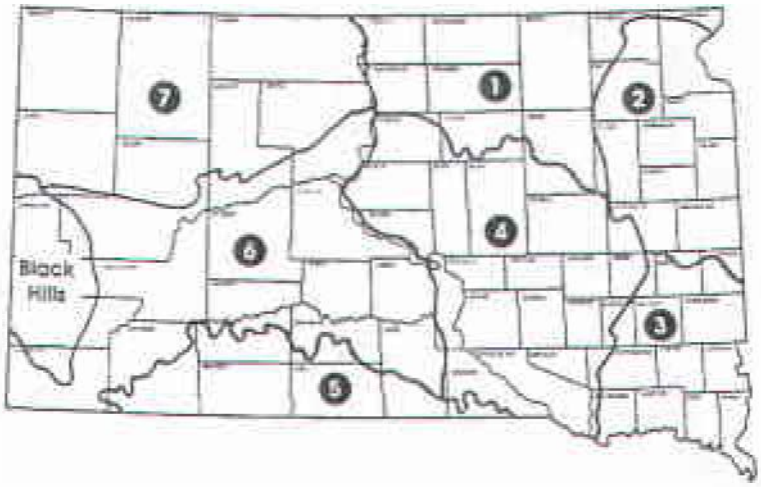
Variety	Height	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	Percent	2006	3-Year
Hard Red						
ALLIANCE	21	0	63.1	8.1	**32.3**	**30**
ARAPAHOE	24	0	61.9	9.9	28.6	26
CRIMSON	26	0	61.6	10.4	**31.7**	27
EXPEDITION	23	0	61.5	9.2	**32.5**	**28**
HARDING	27	0	62.1	10.1	**31.7**	**28**
HARRY	24	0	60.3	9.0	**34.7**	--
HATCHER	21	0	62.2	9.5	**36.9**	--
JAGALENE	23	0	65.3	9.8	**36.7**	**31**
JERRY	25	0	61.2	10.1	29.4	26
MILLENNIUM	24	0	62.3	10.0	31.0	**32**
NEKOTA	22	0	62.8	9.7	**32.1**	**29**
OVERLEY	21	0	64.0	9.9	28.2	--
TANDEM	25	0	61.7	9.9	**33.7**	**29**
WAHOO	24	0	61.7	9.1	**34.9**	**30**
WESLEY	20	0	59.6	9.9	**32.7**	**29**
NE01643	22	0	60.7	9.9	27.4	--
SD96240-3-1	22	0	60.1	10.7	27.2	--
SD97059-2	25	0	61.5	9.9	28.8	27
DARRELL	25	0	64.8	9.4	**37.9**	**32**
SD01058	24	0	62.6	11.6	**33.9**	--
SD01122	24	0	61.4	9.8	28.0	--
SD02279	26	0	61.9	10.5	30.0	--
SD02480	20	0	65.1	10.8	25.2	--
Hard White						
NUDAKOTA	20	0	60.9	9.5	29.8	--
NUFRONTIER	23	0	62.6	9.1	**33.7**	--
TREGO	21	0	59.9	9.3	**34.7**	**32**
WENDY	20	0	62.7	9.7	**31.9**	27
ALICE	22	0	62.6	9.7	**35.9**	27
SD98W175-1	22	0	64.4	9.3	**32.1**	--
SD01W064	25	0	61.5	9.3	29.4	--
Average	22.9	0.0	62.1	9.8	31.8	29
LSD (P=.05)	1.7	0.0	2.8		6.5	4
CV	4.4	0.0	2.7		12.6	15

*0=No lodging, 9 = 100% lodged.

WHEAT VARIETY RECOMMENDATIONS FOR 2007

Crop Adaptation Areas for South Dakota

(Revised 1992)



WINTER WHEAT

Recommended:

Variety	Crop Adaptation Area
Alice (white) [PVP]	1[PC],4[PC],5,6,7[PC]
Darrell [PVP]	1[PC],2,3,4[PC],5,6,7[PC]
Expedition [PVP]	1[PC],4[PC],5,6,7[PC]
Harding [PVP]	1[PC],2[PC],4,7
Jagalene [PVP]	5,6,7[PC]
Millennium [PVP]	1[PC],4[PC],5,6,7[PC]
Wendy (white) [PVP]	5,6,7[PC]
Wesley	5,6,7[PC]

Acceptable/Promising:

Variety	Crop Adaptation Area
Alliance [PVP]	3,4[PC],5,6
Arapahoe [PVP]	1[PC],3,4[PC],5,6,7[PC]
Hatcher [PVP]	5,6,7[PC]
Overland [PVP]	1[PC],3,4[PC],5,6,7[PC]
Wahoo [PVP]	3,4[PC],5,6

SPRING WHEAT

Recommended:

Variety	Crop Adaptation Area
Briggs [PVP]	All except 3
Freyr [PVP]	Statewide
Granger [PVP]	All except 3
Steele-ND [PVP]	All except 3
Traverse [PVP]	Statewide

Acceptable/Promising:

Variety	Crop Adaptation Area
Forge [PVP]	All except 3
Glenn [PVP]	Statewide
Howard [PVP]	All except 3
Knudson [PVP]	All except 3
Oxen [PVP]	All except 3
Reeder [PVP]	5,6,7
Russ [PVP]	All except 3
Ulen [PVP]	All except 3

DURUM WHEAT

Durum wheat is not part of the statewide CPT program, so no recommendations are made. There were trials planted at Bison and Ralph with the results presented on page 16

[PVP] U.S. Plant Variety Protection applied for and/or issued; seed sales of these varieties are restricted to classes of certified seed

[PC] Plant into protective cover

Source - Small Grains and Field Peas 2007 Variety Recommendations, EC774, South Dakota State University (http://plantsci.sdstate.edu/varietytrials/varietal.html)

SPRING WHEAT VARIETY TRIALS

Objective: To evaluate standard and experimental hard red spring wheat varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Plots were seeded at three locations in April 2006 with a John Deere 750 plot drill with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 1,220,000 seeds per acre (90 Lb/A). The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Herbicides were applied in May and varied according to weeds present. Plots were trimmed to 5' x 25' after heading. The wheat was harvested in July with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest. Protein content was determined with a Near Infrared Spectrophotometer (Technicon InfraAlyzer 400).

Location Summaries:

Locations not Harvested

Location	Reason
Perkins County - Bison	Drought

Pennington County – Wall

Planted: April 13, 2006 Herbicide: Starane (12 oz/A) + Harmony (0.3 oz/A) + Puma (10.6 oz/a)

Harvested: July 21, 2006 Additional Nitrogen: None

Previous crop: Chemical fallow

The growing conditions at Wall were good early on, but turned dry and hot in June, yields averaged 35 Bu/A with test weights averaging 62.1 Lb/Bu. The top yielding varieties in 2006 were Traverse, Forge, Ada and Oxen. Forge, Glenn, Granger, Oxen, Reeder and Walworth had the best three year averages. Results are shown in Table 6.

Harding County - Ralph

Planted May 8, 2006 Herbicide: Cleanwave (14 oz/A) + 2,4-D LV6 (8 oz/A), + Puma (6.4 oz/A)

Harvested: July 31, 2006 Additional Nitrogen: 50 lb/A

Previous crop: Conventional fallow

Ralph was also hampered by lack of moisture and hot temperatures which limited average yields to only 32 Bu/A with light test weights averaging 56.1 Lb/Bu. The varieties in the top yield group in 2006 were Oxen, Reeder, Freyr, Ada, Forge and Knudson. The varieties Forge, Oxen, Reeder, Freyr, Russ and Steele-ND had the best three year averages. Results are shown in Table 7.

Table 6. Hard Red Spring Wheat Variety Trial – Pennington County (Wall), 2004-2006

Variety	Height	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	Percent	2006	3 Year
ADA	25	0	63.5	14.0	**37.9**	--
ALSEN	24	0	60.7	13.7	33.1	28
BANTON	26	0	62.1	13.9	31.5	--
BRIGGS	26	0	62.3	12.6	33.3	32
CHAMBERLIN	24	0	63.3	14.9	30.6	--
CHRIS (CK)	28	0	60.3	14.8	31.5	28
FORGE	27	0	63.9	12.1	**38.1**	**34**
FREYR	26	0	62.7	13.2	32.3	**32**
GLENN	27	0	63.9	14.2	**37.5**	**34**
GRANGER	26	0	60.0	12.8	35.3	**33**
GRANITE	22	0	63.4	15.0	29.6	29
HOWARD	27	0	61.9	12.7	34.5	--
KELBY	23	0	62.5	15.1	31.5	--
KNUDSON	24	0	61.4	14.2	31.5	29
NORRIS	26	0	62.7	13.4	32.7	--
OXEN	25	0	62.8	14.0	**36.1**	**33**
REEDER	25	0	61.3	13.2	35.1	**33**
RUSS	26	0	61.0	13.7	35.5	**32**
STEELE-ND	26	0	62.0	13.7	32.7	**32**
TRAVERSE	26	0	61.6	12.5	**38.8**	**32**
TROOPER	22	0	59.5	13.0	32.1	28
ULEN	26	0	62.0	14.2	34.9	**32**
WALWORTH	25	0	60.9	13.0	35.1	**33**
CS3100L (*hard white*)	20	0	63.5	14.1	31.9	--
CS3100Q (*hard white*)	25	0	63.9	12.6	**37.1**	--
SD 3851	28	0	64.5	12.1	**38.1**	--
SD 3860	27	0	61.7	12.8	**37.9**	**36**
SD 3868	26	0	59.1	12.6	**36.5**	**34**
SD 3870	27	0	60.8	12.4	**36.9**	--
SD 3879	27	0	61.2	13.3	**36.1**	--
SD 3927	27	0	64.9	13.6	**36.1**	--
SD 3934	26	0	63.3	13.6	30.8	--
SD 3941	26	0	64.0	13.2	**37.9**	--
SD 3942	24	0	62.6	12.2	**40.0**	--
SD 3943	25	0	62.1	13.2	**37.1**	--
SD 4001	28	0	61.8	14.9	34.7	--
SD 4002	26	0	62.2	12.7	32.3	--
MN 00261-4	25	0	62.4	13.8	30.2	--
ND 803	27	0	62.6	13.6	**36.5**	--
ND 805	25	0	59.1	14.3	34.9	--
Average	25.2	0.0	62.1	13.5	34.7	32
LSD (P=.05)	1.8	0.0	2.8		4.3	4
CV	3.6	0.0	2.8		7.6	10

* 0=No lodging, 9 = 100% lodged.

Table 7 Hard Red Spring Wheat Variety Trial – Harding County (Ralph), 2004-2006

Variety	Height	Lodging	Test Wt.	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu	Percent	2006	3 Year
ADA	28	0	59.2	15.6	**34.3**	--
ALSEN	30	0	56.8	17.2	31.1	39
BANTON	30	0	58.6	14.4	32.1	--
BRIGGS	32	0	56.3	13.6	33.3	39
CHAMBERLIN	27	0	61.1	17.1	28.1	--
CHRIS (CK)	35	0	54.9	15.6	24.7	30
FORGE	31	0	57.4	15.1	**34.1**	**42**
FREYR	29	0	57.9	14.8	**35.0**	**41**
GLENN	33	0	56.4	14.4	32.4	39
GRANGER	33	0	57.2	13.6	32.2	40
GRANITE	24	0	55.5	17.5	27.1	37
HOWARD	30	0	55.9	14.3	**33.7**	--
KELBY	26	0	58.1	15.6	33.0	--
KNUDSON	28	0	58.2	14.6	**34.1**	40
NORRIS	28	0	56.8	16.2	32.4	--
OXEN	28	0	58.4	15.4	**37.3**	**42**
REEDER	28	0	57.5	14.4	**36.7**	**42**
RUSS	33	0	57.7	15.4	33.1	**41**
STEELE-ND	31	0	56.0	16.3	33.5	**41**
TRAVERSE	33	0	55.5	13.4	32.1	40
TROOPER	26	0	56.8	16.5	30.3	38
ULEN	31	0	58.4	14.5	32.2	37
WALWORTH	31	0	55.9	14.2	**33.8**	40
CS3100L (*hard white*)	22	0	**	16.5	26.8	--
CS3100Q (*hard white*)	31	0	55.1	17.4	26.9	--
SD 3851	33	0	57.7	14.2	**36.5**	--
SD 3860	34	0	58.6	14.2	**35.5**	**44**
SD 3868	32	0	54.4	14.0	**34.0**	**43**
SD 3870	32	0	53.0	15.8	32.4	--
SD 3879	34	0	56.8	14.9	**33.8**	--
SD 3927	33	0	59.9	14.2	31.8	--
SD 3934	31	0	57.4	14.8	26.2	--
SD 3941	32	0	60.2	14.6	33.3	--
SD 3942	31	0	56.2	13.6	**34.7**	--
SD 3943	31	0	54.7	14.9	31.9	--
SD 4001	31	0	56.3	16.8	29.4	--
SD 4002	30	0	56.3	14.9	28.6	--
MN 00261-4	26	0	55.3	18.4	26.9	--
ND 803	31	0	57.6	15.0	32.6	--
ND 805	28	0	53.8	15.0	30.5	--
Average	30.0	0	56.9	15.2	32.0	40
LSD (P=.05)	2.1	0	2.6	--	3.7	3
CV	5.0	0	3.3	--	8.2	7

* 0=No lodging, 9 = 100% lodged.

** Sample too wet for an accurate test weight.

DURUM WHEAT VARIETY TRIALS

Objective: To evaluate standard and experimental durum wheat varieties for yield, agronomic characteristics and adaptation to northwestern South Dakota.

Procedure: Plots were seeded at two locations in April 2006 with a John Deere 750 plot drill with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 1,220,000 seeds per acre (90 Lb/A). The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Herbicides were applied in late May and varied according to weeds present. Plots were trimmed to 5' x 25' after heading. The wheat was harvested in July with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest. Protein content was determined with a Near Infrared Spectrophotometer (Technicon InfraAlyzer 400).

Location Summaries:

Locations not Harvested

Location	Reason
Perkins County - Bison	Drought

Harding County - Ralph

Planted May 8, 2006 Herbicide: Cleanwave (14 oz/A) + 2,4-D LV6 (8 oz/A), + Puma (6.4 oz/A)

Harvested: July 31, 2006 Additional Nitrogen: 50 lb/A

Previous crop: Conventional fallow

Ralph yields averaged 30 Bu/A in 2006 with the samples being too wet for an accurate test weight. There was little difference in yields except for Renville having a significantly lower yield. Over the past three years yields were very similar with only Maier yielding statistically less than the other tested varieties. Results are shown in Table 8.

Table 8. Durum Wheat Variety Trial – Harding County (Ralph), 2004-2006.

Variety	Height	Lodging	Test Wt	Protein	Yield	Bu/A
	Inches	0-9*	Lb/Bu**	Percent	2006	4 Year
Alkabo	31	0		17.2	32.4	--
Ben	34	0		19.2	31.1	30.8
Dilse	31	0		18.2	31.7	30.4
Divide	31	0		19.0	32.6	--
Granora	30	0		17.5	32.4	--
Lebsock	32	0		18.3	29.5	31.5
Maier	31	0		19.4	31.1	28.6
Mountrail	30	0		18.4	27.4	32.7
Renville	33	0		18.9	27.0	29.9
Vic	32	0		16.9	28.5	30.2
Average	31.3	0.0		18.3	30.4	31.1
LSD (P=.05)	2.8	0.0		--	5.3	3.6
CV	6.1	0.0		--	11.9	16.5

* 0=No lodging, 9 = 100% lodged.

** Samples were too wht to get an accurate test weight.

OAT AND BARLEY VARIETY RECOMMENDATIONS FOR 2007

Crop Adaptation Areas for South Dakota

(Revised 1992)

OATS

Recommended:

Variety	*Crop Adaptation Area*
Don	1,4,5,6,7
Loyal	1,2,7
Jerry PVP (non-title V status)	1,4,5,6,7
Reeves	Statewide
Stallion	1,2,7

Acceptable/Promising:

Variety	*Crop Adaptation Area*
Beach	5,6,7
HiFi	1,2,7
Morton	1,2,7
Buff (hull-less)	Statewide

SPRING BARLEY

Recommended:

Variety	*Crop Adaptation Area*
6 Row	
Excel PVP	1,2,4,6,7
Lacey PVP	Statewide
2 Row	
Haxby PVP (feed)	6,7
Eslick PVP (feed)	6,7

Acceptable/Promising:

Variety	*Crop Adaptation Area*
6 Row	
Drummond PVP	Statewide
Robust PVP	1,2,4,6,7
Tradition PVP	Statewide
2 Row	
Conlon PVP	1,4,6,7
Rawson (feed)	1,2,7

Conlon, Drummond, Excel, Foster, Lacey, Legacy, Morex, Robust and Tradition are approved American Malting Barley Association varieties for South Dakota - 2007.

PVP U.S. Plant Variety Protection applied for and/or issued, seed sales of these varieties are restricted to classes of certified seed.

Source - Small Grains 2007 Variety Recommendations, EC774, South Dakota State University (http://plantsci.sdstate.edu/varietytrials/varinal.html)

OAT VARIETY TRIALS

Objective: To evaluate standard and experimental oat varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Plots were seeded at three locations in April 2006 with a John Deere 750 plot drill with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 1,220,000 seeds per acre (64 Lb/A). The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Herbicides were applied in May and varied according to weeds present. Plots were trimmed to 5' x 25' after heading. The oats were harvested in July with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest. Protein content was determined with a Near Infrared Spectrophotometer (Technicon InfraAlyzer 400).

Location Summaries:

Locations not Harvested

Location	Reason
Perkins County - Bison	Drought

Pennington County - Wall

Planted: April 13, 2006
Harvested: July 21, 2006
Previous crop: Chemical fallow

Herbicide: Buctril (16 oz/A) + MCPA (6 oz/A)
Additional Nitrogen: 80 Lb/A

The growing conditions at Wall were dry for oats in 2006. The weather was good early on but turned hot and dry in June. The trial averaged 61 Bu/A with light test weights averaging 37.5 Lb/Bu. Top performing varieties in 2006 were Baker, Beach, Stallion and Hifi. There was no difference in the yields of varieties with three year averages. Among the hull-less varieties Buff performed significantly better than Paul in 2006 and over the past three years. Results are presented in Table 9.

Jones County - Okaton

Planted: April 17, 2006
Harvested: July 21, 2006
Previous crop:

Herbicide: None
Additional Nitrogen:

Growing conditions were tough for oats at Okaton in 2006. This location received very little significant growing season rainfall and June was very hot. This limited yields to 42 Bu/A with average test weights of 34.8 Lb/Bu. The best yielding varieties in 2006 were Don, Madia, Stallion, Beach, and Baker. Results are presented in Table 10.

Table 9. Oat Variety Trial - Pennington County (Wall), 2004-2006.

Variety	Heading Date*	Height Inches	Lodging 1-9**	Test Wt Lb/Bu	Protein Percent	Yield 2006	Bu/A 3 Year
BUFF HULLESS	3	24	0	43.6	18.5	45.8	40
STARK HULLESS	6	29	0	38.3	19.1	39.7	30
PAUL HULLESS	7	28	0	40.6	18.5	44.4	30
DON	1	23	0	36.5	13.9	58.8	**52**
REEVES	2	27	0	36.6	16.4	46.6	**46**
HYTEST	4	30	0	38.3	17.4	51.4	**49**
BAKER	4	26	0	35.4	15.3	**69.9**	--
JERRY	5	26	0	36.9	17.5	57.7	**55**
BEACH	6	28	0	38.8	14.9	67.7	--
MORTON	7	28	0	37.1	15.9	61.9	**53**
MADIA	7	28	0	36.5	15.8	57.7	--
HIFI	8	26	0	36.1	15.5	65.5	**52**
LOYAL	8	27	0	37.2	15.9	61.9	**50**
STALLION	8	27	0	39.3	15.1	65.5	**53**
SD 011315-15		26	0	37.8	15.0	**73.0**	--
SD 020536		25	0	39.4	15.7	66.9	--
SD 020701		26	0	38.4	15.9	**70.2**	--
SD 020883		26	0	39.9	16.5	60.2	--
SD 021021		24	0	31.5	15.7	66.9	--
SD 030324		28	0	36.0	16.7	65.8	--
SD 030888		23	0	39.4	17.5	66.6	--
SD 031128		28	0	38.0	15.4	62.2	--
ND 961161		24	0	36.6	16.4	**69.9**	--
GG-304		18	0	31.8	15.9	58.0	--
Average		25.9	0.0	37.5	16.3	60.6	46
LSD (P=.05)		1.9	0.0	3.3		4.9	10
CV		5.2	0.0	6.1		5.7	15

* Heading Date, relative difference in days compared to Don.

** 0 = No Lodging, 9 = 100% lodged.

Table 10. Oat Variety Trial – Jones County (Okaton), 2006.

Variety	Heading Date*	Height Inches	Lodging 1-9**	Test Wt Lb/Bu	Protein Percent	Yield Bu/A
BUFF HULLESS	3	22	0	43.2	18.6	32.2
STARK HULLESS	6	24	0	***	19.2	18.3
PAUL HULLESS	7	24	0	40.3	18.1	26.6
DON	1	22	0	34.1	15.0	**46.3**
REEVES	2	27	0	36.0	14.9	39.9
HYTEST	4	26	0	37.0	16.3	38.0
BAKER	4	24	0	31.8	16.2	43.8
JERRY	5	24	0	35.0	16.7	40.5
BEACH	6	23	0	36.4	15.6	43.8
MORTON	7	25	0	32.0	16.7	41.0
MADIA	7	24	0	33.4	16.1	**44.6**
HIFI	8	24	0	32.0	15.7	40.8
LOYAL	8	23	0	33.7	16.1	37.4
STALLION	8	24	0	34.7	16.0	43.8
SD 011315-15		21	0	31.6	15.2	**48.0**
SD 020536		21	0	36.1	15.7	**47.7**
SD 020701		24	0	34.5	14.9	**52.1**
SD 020883		24	0	37.7	16.5	**45.5**
SD 021021		22	0	34.7	15.6	**51.6**
SD 030324		24	0	32.3	16.2	42.1
SD 030888		19	0	35.9	17.0	**48.8**
SD 031128		24	0	36.1	15.4	**48.2**
ND 961161		21	0	34.8	15.7	**48.2**
GG-304		15	0	27.0	15.6	33.8
Average		23.0	0.0	34.8	16.2	41.8
LSD (P=.05)		2.0	0.0	1.6		8.0
CV		6.3	0.0	3.2		13.5

* Heading Date, relative difference in days compared to Don.
** 0 = No Lodging, 9 = 100% lodged.
*** Not enough sample for a test weight.

SPRING BARLEY VARIETY TRIALS

Objective: To evaluate standard and experimental spring barley varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Plots were seeded at three locations in April 2006 with a John Deere 750 plot drill with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 1,220,000 seeds per acre (117 Lb/A for two row, 83 Lb/A for six-row). The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Herbicides were applied in May and varied according to weeds present. Plots were trimmed to 5' x 25' after heading. The barley was harvested in July and August with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest. Protein content was determined with a Near Infrared Spectrophotometer (Technicon InfraAlyzer 400).

Location Summaries:

Locations not Harvested

Location	Reason
Perkins County - Bison	Drought

Pennington County - Wall

Planted: April 13, 2006 Herbicide: Buctril (16 oz/A) + MCPA (6 oz/A)
Harvested: July 21, 2006 Additional Nitrogen: 80 Lb/A
Previous crop: Chemical fallow

At Wall, yields averaged 47 Bu/A and test weights averaged 46.9 Lb/Bu. Because of this stressful environment in 2006, the two row types performed better than the six row types. Over the past three years Conlon, Haxby, Eslick, Excel and Robust have performed the best. The varieties Haxby and Eslick are from Montana State University that were bred and selected for their feeding qualities for beef production with feed values similar to corn. Results are shown in Table 11.

Harding County - Ralph

Planted May 8, 2006 Herbicide: Cleanwave (14 oz/A) + 2,4-D LV6 (8 oz/A), + Puma (6.4 oz/A)
Harvested: July 31, 2006 Additional Nitrogen: 50 lb/A
Previous crop: Conventional fallow

The average yield was 33 Bu/A at Ralph in 2006. The trial was quite variable and the data was unusable, so yields for Ralph were not reported this year.

Table 11. Spring Barley Variety Trial - Pennington County (Wall), 2004-2006.

	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Protein Percent	Yield 2006	Bu/A 3 Year
TWO ROW						
CONLON	20	0	47.6	11.3	**52.6**	**53**
ESLICK	20	0	47.0	9.4	**56.0**	**48**
HAXBY	21	0	49.4	10.7	**56.1**	**50**
RAWSON	22	0	46.2	11.4	**52.6**	–
SIX ROW						
DRUMMOND	22	0	46.9	11.4	47.7	42
EXCEL	22	0	44.0	10.3	**52.2**	**45**
LACEY	22	0	45.1	10.6	49.2	42
LEGACY	21	0	43.6	11.0	49.2	41
ROBUST	22	0	45.3	11.2	44.8	**43**
STELLAR-ND	22	0	44.4	10.2	42.0	36
TRADITION	22	0	47.4	11.1	43.5	39
HULL-LESS						
MERESSE	18	0	51.3	11.2	40.3	–
PRONGHORN	21	0	46.0	12.8	35.2	–
STANUWAX	20	0	52.6	12.7	35.2	–
Average	21.0	0.0	46.9	11.1	46.9	44
LSD (P=.05)	1.6	0.0	1.4		3.9	7
CV	5.4	0.0	2.0		5.9	12

* 0 = no lodging, 9 = 100% lodged.

SAFFLOWER VARIETY TRIALS

Objective: To evaluate safflower varieties for yield and adaptation to western South Dakota.

Procedure: Safflower varieties were planted at 18 Lb/A in a randomized complete block experiment with four replications near Wall and Hayes South Dakota. The plots were planted in May with a John Deere 750 drill set to 10-inch row spacing. The plots received 7.4 lbs N and 25 lbs P_2O_5 per acre as 10-34-0 with the seed. Plots were trimmed to 5' x 25' before harvest. Height, shatter, and lodging notes were taken at the time of harvest. The plots were harvested with a Wintersteiger Delta small plot combine.

Pennington County - Wall

Planted: May 4, 2006
Harvested: September 5, 2006
Previous crop: Chemical fallow

Herbicide: Prowl (3 pt/A)
Additional Nitrogen: 80 Lb/A

Stanley County - Hayes

Planted: May 3, 2006
Harvested: Not harvested
Previous crop: Wheat, no-till planted

Herbicide: Spartan (3 oz/A)
Additional Nitrogen: None

Discussion: In 2006, safflower yields at Wall were near average at 1271 Lb/Bu with excellent seed quality. The seed had good color and test weights averaged 37.7 Lb/Bu. The varieties SeedTec S-518, Montola 2004, 9022 hybrid, Montola 2000, SeedTec S-541 and Finch did well over the last three years. Finch would be the best variety to plant for the birdseed market with its combination of white hull, excellent test weights and consistent top yields. For the oil markets, S-541 is the best linoleic type and S-518, Montola 2004 and Montola 2000 are the best oleic types. Nutrasaff is a variety that has high linoleic oil, reduced hull and fiber content. It is targeted to the feed market for sheep and cattle. Results are shown in Table 12.

Table 12. Safflower Variety Trial –Pennington County (Wall) 2004-2006.

Variety	Hull Color	Height Inches	Lodging 0-9*	Oil Percent	Test Wt Lb/Bu	Yield 2006	Lb/A 3-Year
Linoleic types							
Finch	White	19	0	45.4	33.8	1237	1112
SeedTec S-541	Stripe	20	0	40.9	39.5	915	1130
Oleic types							
Montola 2000	White	16	0	39.6	38.3	1246	1153
Montola 2001	Stripe	17	0	39.9	38.6	1211	993
Montola 2003	White	18	0	41.4	38.0	1150	1034
Montola 2004	White	17	0	41.7	36.6	1350	1188
SeedTec S-344	White	19	0	39.0	38.6	1263	--
SeedTec S-518	Stripe	18	0	39.7	37.2	1246	1283
High Linoleic, High Oil							
Nutrasaff	Brown	19	0	40.1	44.4	1028	891
Hybrids							
9022 hybrid	Mixed	22	0	44.2	33.8	1298	1165
9049-1 hybrid		19	0	42.7	35.5	**1481**	--
9049-2 hybrid		18	0	42.9	33.9	1376	--
Experimentals							
SeedTec 1133exp		20	0	39.5	40.8	1350	--
SeedTec 1143exp		18	0	40.4	37.9	1272	--
SeedTec 3151exp		19	0	41.4	39.5	**1533**	--
SeedTec 4409exp		19	0	43.1	36.8	1376	--
Average		18.5	0	41.4	37.7	1271	1105
LSD (P=.05)		1.1	0.0	2.2		142	--
CV		4.3	0.0	3.7		7.8	--

* 0=No lodging, 9= 100% lodged.

FIELD PEA VARIETY TRIALS

Objective: To evaluate field pea varieties for yield and adaptation to western South Dakota

Procedure: Field peas were planted in a randomized complete block experiment with four replications near Selby, Hayes, Wall and Bison, South Dakota. The seeding rate was 300,000 seeds/A (90 - 220 Lb/A) and the peas were inoculated with a granular pea inoculum (*Rhizobium leguminosarium* biovar *viceae)* just prior to planting. A John Deere 750 drill with 10-inch spacing was used to plant the trials in April 2006. The peas were harvested for grain in July with a small plot combine equipped with vine lifters and a pickup reel.

Location Information:

Locations not Harvested

Location	Reason
Perkins County - Bison	Drought
Walworth County – Selby	Drought

Pennington County – Wall

Planted: April 11, 2006
Harvested: July 24, 2006
Previous crop: Wheat, no-till planted
Herbicide: Spartan (3 oz/A)
Additional Nitrogen: Inoculated

Stanley County - Hayes

Planted: April 12, 2006
Harvested: July 17, 2006
Previous crop: Wheat, no-till planted
Herbicide: Spartan
Additional Nitrogen: Inoculated

Summary: Yields at Wall were normal for West River, with a average of 26 bu/A. Hayes suffered from very dry and hot weather limiting yields to only 16 bu/A. The Beresford yields were excellent, averaging 64 bu/A, with the better varieties in the high 70's. The top yielding varieties in 2006 were Polestead, Cooper, and Tamora. Variety characteristics are presented in Table 13 and yield results in Table 14.

Table 13. Field Pea Characteristics.

Variety	Maturity	Seed color	Height Inches	Lodging (0-9)~	Powdery mildew@	Mycos-phaerella blight@	Fusarium Wilt@	Seeds per Lb
AP-18	M	Green	17	1	-	-	-	2100
Aragorn	M	Green	14	-	-	-	-	2200
Camry	M	Green	12	1	VG	F	F	2000
CDC Striker	M	Green	17	-	F	F	G	1900
CEB 1093	M	Green	15	-	-	-	-	1700
Cooper	L	Green	14	0	VG	F	F	1700
Cruiser	M	Green	17	3	P	F	P	2200
K2	M	Green	15	-	-	-	-	2200
Majoret	E	Green	16	1	P	F	P	2100
Stratus	M	Green	12	5	VG	F	P	1900
Tamora	L	Green	16	-	-	-	-	1700
Carneval	M	Yellow	17	0	F	F	P	2100
CDC Mozart	M	Yellow	13	4	VG	P	F	2100
DS-Admiral	E	Yellow	16	1	VG	F	F	2000
Eclipse	M	Yellow	12	1	VG	F	F	1900
Fusion	M	Yellow	14	-	-	-	-	2000
Grande	M	Yellow	16	6	P	F	P	2300
Integra	E	Yellow	14	1	P	P	F	1900
Polstead	M	Yellow	13	-	-	-	-	1900
SW Cabot	E	Yellow	13	-	P	P	P	1900
SW Capri	E	Yellow	16	-	P	F	P	2200
SW Marquee	E	Yellow	17	0	-	-	-	2300
SW Midas	E	Yellow	15	0	VG	F	F	2200
SW Salute	E	Yellow	16	3	VG	F	P	2000
Topeka	E	Yellow	13	6	VG	F	P	2100
Tudor	M	Yellow	16	0	VG	P	F	1700

~ 0=No lodging, 9 = 100% lodged (2005 data)

@ Very good- VG, good- G, fair- F, poor- P disease resistance.

Table 14 Field Pea Variety Trial Yields (Bu/A), 2006

Variety (maturity)	Wall	Hayes	Beresford	Average	Top Yield Frequency (%)**
Yellow Cotyledon					
Carneval (M)	23	15	54	31	0
CDC Mozart (M)	25	14	**72**	37	33
DS-Admiral (E)	26	15	62	34	0
Eclipse (M)	28	**16**	67	37	33
Fusion (M)	27	14	66	36	0
Grande (M)	26	**16**	60	34	33
Integra (E)	26	13	54	31	0
Polstead (M)	**33**	**18**	**79**	43	**100**
SW Cabot (E)	27	**16**	64	36	33
SW Capri (E)	24	**17**	66	36	33
SW Marquee (E)	19	13	68	33	0
SW Midas (E)	**30**	**16**	68	38	67
SW Salute (E)	26	15	70	37	0
Topeka (E)	**30**	15	67	37	33
Tudor (M)	28	15	**74**	39	33
Green Cotyledon					
AP-18 (M)	21	14	60	32	0
Aragorn (M)	23	14	62	33	0
Camry (M)	**32**	**17**	64	38	67
CDC Striker (M)	16	10	59	28	0
CEB 1093 (M)	26	13	64	34	0
Cooper (L)	**33**	**17**	**76**	42	**100**
Cruiser (M)	24	13	56	31	0
K2 (M)	22	12	45	26	0
Majoret (E)	22	13	39	25	0
Stratus (M)	**30**	**16**	**77**	41	**100**
Tamora (L)	28	14	63	35	0
Average (Grain Types)	26	15	64	36	.
LSD (P=.05)	3	2	7	--	.
CV	9	9	8	--	.

** Percentage of test locations where a variety was in the top–yield group.
Maturity rating E = early, M = medium, L = late

CHICKPEA VARIETY TRIALS

Objective: To evaluate chickpea varieties for yield and adaptation to western South Dakota.

Procedure: Chickpea varieties were planted in a randomized complete block experiment with four replications near Hayes and Wall, South Dakota. Most of the varieties are large kabuli types, which are grown for the large seeded garbanzo bean market. One of the varieties (Amit) is a smaller sized kabuli for export into the desi market. The other varieties are desi types, which accounts for 85-90% of the market outside the United States and is grown as a protein source for humans and livestock. A planting rate of 174,000 was used (75-180 Lb/A) and the seed was inoculated with chickpea inoculum (*Mesorhizobium* sp. *ciceri)* prior to planting. The plots were planted in April with a John Deere 750 drill set to 10-inch row spacing and inoculated with chickpea inoculum (*Mesorhizobium* sp. *ciceri)* prior to planting. The plots were harvested in August with a small plot combine.

Pennington County - Wall

Planted: April 11, 2006
Harvested: August 10, 2006
Previous crop: Wheat, no-till planted
Herbicide: Spartan
Additional Nitrogen: Inoculated

Stanley County - Hayes

Planted: April 12, 2006
Harvested: August 2, 2006
Previous crop: Wheat, No-till planted
Herbicide: Spartan
Additional Nitrogen: Inoculated

Discussion: Chickpea yields were decent at Wall and below average at Hayes in 2006. Hayes and Wall averaged 748 and 1291 Lb/A respectively. Hayes especially needed some July moisture which hurt overall yields there. For chickpeas, the best varieties should yield well and have large seed size. Preferred varieties should grade out 80% or better larger than 22/64, as this is the size that is worth the most (Table 18). The best large kabuli varieties are Dylan, Sierra and CDC Xena. These varieties have shown good yield and large seed size in trials over the past several years. Other varieties yielded better but do not have large enough seed to grade well. Table 15 shows chickpea agronomic characteristics and Tables 16 and 17 show yields. Desi chickpeas typically have had better yields than kabuli types in South Dakota trials, but currently have a very limited market in the United States. Chickpeas are well adapted to the dry, semi-arid climate of western South Dakota and can be a profitable crop if quality characteristics are met.

Table 15 Chickpea Variety Characteristics.

Variety	Seed Color	Height Inches	Lodging 0-9*	Seed Size (Seeds/oz) Wall	Hayes
Large Kabuli					
Dwelly	Cream	15	0	67	70
Sierra	Cream	14	0	67	64
Dylan	Cream	14	0	62	56
CDC Yuma	Cream	16	0	83	68
CDC Xena	Cream	13	0	68	67
CDC Frontier	Cream	13	0	87	84
Small Kabuli					
Amit (B-90)	Cream	13	0	136	115
Desi					
CDC Anna	Brown	15	0	162	157
CDC Cabri	Brown	17	0	112	98
CDC Desiray	Brown	14	0	154	147
CDC Nika	Brown	14	0	96	96
Large Kabuli experimentals					
CA9783163C	Cream	15	0	74	68
CA9990B1579C	Cream	15	0	68	63
CA0090B347C	Cream	14	0	74	73
CA0190B839C	Cream	19	0	60	70
CA9890233W	White	16	0	78	60
CA9990I875W	White	15	0	72	63
Average		15	0	89	83

*0=No lodging, 9= 100% lodged.

Table 16. Kabuli Chickpea Variety Trial Yields (Lb/A), 2004-2006.

	Wall		Hayes	
Variety	2006	3-year	2006	3-year
Large Kabuli				
Dwelly	1150	1169	583	939
Sierra	1411	1245	**845**	999
Dylan	1385	**1292**	**828**	1065
CDC Yuma	1411	1193	741	1054
CDC Xena	1472	1275	**784**	**1145**
CDC Frontier	1437	**1301**	**862**	**1255**
Small Kabuli				
Amit (B-90)	**1586**	1277	**958**	**1213**
Large Kabuli experimentals				
CA9783163C	1237	1216	592	884
CA9990B1579C	1211	--	767	--
CA0090B347C	**1734**	**1441**	**871**	**1237**
CA0190B839C	1263	--	531	--
CA9890233W	697	792	610	845
CA99901875W	784	935	680	839
Average	1291	1194	748	1043
LSD (P=.05)	1307	152	180	147
CV	13.1	15.9	16.9	17.9

Table 17. Desi Chickpea Variety Trial Yields (Lb/A), 2004-2006.

	Wall		Hayes	
Variety	2006	3-year	2006	3-year
Desi				
CDC Anna	1781	1326	**1054**	1217
CDC Cabri	1803	1276	**915**	1208
CDC Desiray	1586	1271	880	1173
CDC Nika	1677	1246	**958**	--
Average	1712	1280	952	1199
LSD (P=.05)	**NS**	**NS**	145	**NS**
CV	18.9	19.6	9.5	20.1

Table 18 Chickpea Seed Size Grades (2005).

	Wall				Hayes			
Variety	over 22/64"	over 20/64"	over 18/64"	under 18/64"	over 22/64"	over 20/64"	over 18/64"	under 18/64"
Dwelly	66%	27%	5%	2%	68%	24%	6%	2%
Sierra	**73%**	19%	6%	2%	**80%**	18%	2%	1%
Dylan	**87%**	9%	3%	2%	**87%**	10%	2%	1%
CDC Yuma	34%	44%	17%	4%	**71%**	23%	5%	1%
CDC Xena	45%	51%	4%	1%	69%	25%	5%	1%
CDC Frontier	15%	59%	23%	3%	24%	60%	15%	1%
Amit (B-90)	0%	1%	28%	71%	3%	9%	48%	41%
CA9783163C	60%	30%	7%	3%	**73%**	18%	5%	3%
CA9990B1579C	68%	25%	6%	2%	**88%**	9%	2%	1%
CA0090B347C	45%	46%	7%	2%	52%	40%	7%	1%
CA0190B839C	**87%**	10%	2%	1%	**72%**	20%	5%	4%
CA9890233W	60%	18%	12%	10%	**86%**	8%	4%	3%
CA9990I875W	63%	21%	10%	6%	**82%**	7%	5%	5%

WINTER PEA VARIETY TRIALS

Objective: To evaluate winter field pea varieties for yield and adaptation to western South Dakota.

Procedure: Winter field pea varieties from Washington State University were planted in a randomized complete block experiment with four replications near Wall South Dakota. The seeding rate was 520,000 seeds/A (115 - 150 Lb/A) and the peas were inoculated with a granular pea inoculum (*Rhizobium leguminosarium* biovar *viceae)* just prior to planting. A John Deere 750 drill with 10-inch spacing was used to plant the trials in September 2005.

Location Information:

Pennington County – Wall

Planted: September 28, 2005 Herbicide: None
Harvested: Not harvested Additional Nitrogen: Inoculated
Previous crop: Wheat, No-till planted

Summary: This is the fourth year winter peas have been grown in South Dakota. No herbicides were applied to this trial and weed competition was a major problem along with poor stands from winter kill. Because of this, the plots were not harvested. Further research continues with a variety trial planted at Wall again this year.

WINTER LENTIL VARIETY TRIALS

Objective: To evaluate winter lentil varieties for yield and adaptation to western South Dakota.

Procedure: Winter lentil varieties from Washington State University were planted in a randomized complete block experiment with four replications near Wall, South Dakota. The seeding rate was 520,000 seeds/A (25 - 35 Lb/A) and the lentils were inoculated with a granular lentil inoculum (*Rhizobium leguminosarium* biovar *viceae)* just prior to planting. A John Deere 750 with 10-inch spacing was used to plant the trials in September 2005.

Location Information:

Pennington County – Wall

Planted: September 28, 2005
Harvested: Not harvested
Previous crop: Wheat, No-till planted
Herbicide: None
Additional Nitrogen: Inoculated

Summary: This is the fourth year winter lentils have been grown in South Dakota. No herbicides were applied to this trial and weed competition was a major problem, because of this the plots were not harvested. The lentils survived the winter very well and unlike the winter peas, look adapted to our climate. Further research continues with a trial planted at Wall again this year looking at both varieties and seeding rates.

MUSTARD VARIETY TRIAL

Objective: To evaluate standard and experimental mustards (*Brassica juncea*-brown mustard and *Brassica napus*-canola) varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Plots were seeded at one location on April 13, 2006 with a John Deere 750 plot drill with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 4 pounds per acre. Plots were trimmed to 5' x 25' after heading. The Mustard was harvested on July 26, 2006 with a small plot combine. Height and lodging were taken at the time of harvest.

Pennington County - Wall

Planted: April 13, 2006 Herbicide: Poast (1 pint / A) May 30, 2006
Harvested: July 26, 2006 Additional Nitrogen: 80 lb/A
Previous crop: Failed proso millet (chemical fallow)

Summary: At Wall, yields averaged a very low 19.7 lb/A. Test weights were not available because the yield sample was too small to be measured. The dry and very hot conditions caused very low yields and a large amount of plot variation. There was a high level of variability for yield in this trial. Because of the high coefficient of variation (CV) yield comparisons can not be made. Results are shown in Table 19.

Table 19. Mustard Variety Trial - Pennington County (Wall), 2006.

Variety	Height Inches	Yield Lb/A
Hyola 401	24	29.0
Hyola 357 Mag RR	24	22.0
IS3465 RR	27	8.0
IS7145 RR	28	17.5
Hylite 18CL	30	35.8
431 RR Hyclass	28	8.0
767SWRR Hyclass	28	16.3
712 RR Hyclass	31	28.0
905 RR Hyclass	29	34.3
SW Titan RR	28	14.5
SW Marksman RR	32	23.0
SW Patriot RR	31	17.0
Arid	28	13.3
Dahinda	27	27.3
DKL 34 55	28	13.5
DKL 38 25	30	17.8
DKL 52 10	31	18.5
Farmer	34	32.5
Crambe	18	0.0
Average	28.0	19.7
LSD (P=.05)	3.18	13.7
CV	8.0	49.0

CAMELINA VARIETY TRIAL

Objective: To evaluate Camelina (*Camelina sativa)* varieties for yield, agronomic characteristics and adaptation to western South Dakota.

Procedure: Camelina, also known as falseflax, is an oilseed crop with potential for biodiesel production. Plots were seeded at one location on April 13, 2006 with a John Deere 750 plot drill with 10 inch spacing. The experimental design was a randomized complete block with four replications. The seeding rate was 3 pounds per acre. Plots were trimmed to 5' x 25' after heading. The Camelina was harvested on July 26, 2006 with a small plot combine. Height and lodging notes were taken at the time of harvest.

Pennington County - Wall

Planted: April 13, 2006 Herbicide: Poast (1 pint / A) May 30, 2006
Harvested: July 26, 2006 Additional Nitrogen: 80 lb/A
Previous crop: Failed proso millet (chemical fallow)

Summary: At Wall, yields averaged 177 lb/A and test weights averaged 50.3 Lb/Bu. The dry very hot conditions resulted in low yields and a large amount of plot variation. Because of the high coefficient of variation (CV) yield comparisons can not be made. Results are shown in Table 20.

Table20. Camelina Variety Trial - Pennington County (Wall), 2006.

Variety	Height Inches	Test Wt Lb/Bu**	Yield Lb/A
BSX G21	18	51.2	192
BSX G51	18	50.1	242
BSXG52	16	49.6	81
BSXG53	18	49.7	139
BSXG61	18	51.7	222
BSXG62	16	50.2	144
BSXG63	20	51.6	266
BSX G71	19	52.1	189
BSX G72	18	50.8	241
BSX G73	19	49.7	208
Calena	18	51.9	239
Ligena	17	48.3	108
NEExp682	17	50.0	141
NEExp684	18	47.5	81
NEExp684B	17	48.8	128
NEExp985	17	51.8	215
Average	17.6	50.3	177
LSD (P=.05)	1.6	0.9	65
CV	6.5	1.3	25

OAT / FIELD PEA FORAGE TRIAL

Objectives:
1. To evaluate different seeding rates of oats and field peas planted in a mix.
2. Compare oat / field pea mixes to peas and oats planted alone.
3. Compare long vine forage pea to short vine semi-leafless grain pea.

Procedure: The study was planted in a randomized complete block experiment with four replications near Wall, South Dakota. The ground was chemical fallow the previous year. A John Deere 750 plot drill with 10-inch spacing was used to plant the trial on May 4, 2008. The peas were inoculated with a granular pea inoculum (*Rhizobium leguminosarum* biovar *viceae*) just prior to planting. The plot was fertilized with 80 lb/acre of nitrogen in April. The oat variety Jerry along with the pea varieties Arvika (long vine forage type) and Carneval (semi-leafless grain type) were used. In 2008 only the forage type Arvika was used in the trial. The seeding rates are listed in the table below. The trial was harvested on June 28, 2008 when the peas were at mid-pod fill and the oats late milk to early dough stage. Subsamples from each plot were analyzed for acid detergent fiber (ADF), neutral detergent fiber (NDF) and crude protein. The ADF and NDF numbers were then used to calculate relative feed value (RFV) with a higher RFV showing better quality forage.

Seeding Rates Used for Forage Study

	Full Rate*	½ Rate	¼ Rate
Jerry Oat	64 lb/A	32 lb/A	16 lb/A
Carneval Pea	150 lb/A	75 lb/A	
Arvika Pea	90 lb/A	45 lb/A	

** Full and ½ rate of peas are 300,000 and 150,000 seeds/acre respectively.*

Summary: The trial averaged 2.6 ton/A, which was fairly good considering the dry and hot conditions. Over the past three years (Table 24) the highest yields were from oats alone and the mixes with a full rate of oats; peas alone were lower yielding than the mixes. There was no yield difference between the forage and grain type peas over the two years they were tested. Seeding rates in a mix of 32 lb/A for oats and 150,000 seeds/acre for field peas were adequate to maximize yield for the mixes.

Arvika had higher protein content than Carneval and Jerry oat. The higher protein levels and RFV in Arvika peas may be partly due to its later maturity than Carneval. It also should be noted that no LDP can be obtained from a field planted to a mix, a producer might want to consider planting one field to peas and one to oats and mix the hay when feeding.

Table 21 Oat / Field Pea Forage Trial – Pennington County (Wall), 2004.

Treatment	Moisture %	Yield Ton/A 13%	% Crude Protein	NDF %	ADF %	RFV
Full Arvika	75	1.16	17.4	26.5	18.2	263
Full Carneval	73	1.15	13.2	36.0	23.7	187
Full Oat	67	**1.30**	13.3	44.2	**25.4**	150
Full Arvika / Full Oat	67	**1.27**	14.1	43.8	24.9	148
Full Arvika / ½ Oat	68	**1.45**	13.4	42.4	24.0	155
Full Arvika / ¼ Oat	71	1.23	15.2	36.6	22.1	184
½ Arvika / Full Oat	69	1.25	12.4	47.5	26.5	135
½ Arvika / ½ Oat	69	**1.48**	12.3	47.5	26.7	133
½ Arvika / ¼ Oat	71	1.11	14.0	41.6	24.3	160
Full Carneval / Full Oat	67	**1.47**	12.4	48.9	26.8	130
Full Carneval / ½ Oat	69	**1.28**	13.6	45.7	25.8	141
Full Carneval / ¼ Oat	71	**1.37**	12.5	44.4	26.6	143
½ Carneval / Full Oat	64	**1.42**	11.6	47.2	25.9	136
½ Carneval / ½ Oat	69	**1.27**	13.0	46.8	26.3	136
½ Carneval / ¼ Oat	71	1.03	13.7	43.6	25.6	149
½ Arvika / ½ Triticale	67	1.00	13.4	40.3	23.7	163
Average	69	1.27	65.8	15.7	35.4	54.8
LSD (P=.05)	3	0.22	4.0	2.0	2.8	3.8
CV	3.2	12.3	4.3	9.0	5.6	4.8

NDF% = Neutral Detergent Fiber
ADF% = Acid Detergent Fiber
RFV = Relative Feed Value

Table 22. Oat / Field Pea Forage Trial – Pennington County (Wall), 2005.

Treatment	Moisture %	Yield Ton/A 13%	IVDMD %	% Crude Protein	NDF %	ADF %	RFV
Full Arvika	75	1.01	68.6	23.0	34.6	41.9	138
Full Carneval	75	1.32	75.3	20.2	30.3	40.6	150
Full Oat	60	**1.95**	63.4	12.7	37.0	61.0	92
Full Arvika / Full Oat	58	**1.89**	61.7	14.6	35.7	57.4	100
Full Arvika / ½ Oat	61	1.78	65.5	16.3	34.8	54.6	106
Full Arvika /¼ Oat	66	1.38	68.1	21.2	34.3	51.3	114
½ Arvika / Full Oat	60	**1.91**	65.0	13.2	36.4	59.4	95
½ Arvika / ½ Oat	66	1.53	65.6	14.5	36.5	53.2	106
½ Arvika / ¼ Oat	70	1.46	66.0	17.7	35.0	53.1	108
Full Carneval / Full Oat	61	**1.94**	63.2	12.6	36.6	57.1	98
Full Carneval / ½ Oat	61	**1.94**	64.5	13.6	36.3	58.4	97
Full Carneval / ¼ Oat	63	1.60	67.1	15.8	35.9	55.0	103
½ Carneval / Full Oat	60	**2.13**	62.1	11.5	37.5	61.2	91
½ Carneval / ½ Oat	62	1.73	64.1	13.1	34.6	59.6	97
½ Carneval / ¼ Oat	67	1.76	64.2	14.3	35.0	57.5	100
½ Arvika / ½ Triticale	63	1.55	68.8	17.3	35.2	55.1	104
Average	64.2	1.68	65.8	15.7	35.4	54.8	106
LSD (P=.05)	6.6	0.24	4.0	2.0	2.8	3.8	9.5
CV	7.2	10.0	4.3	9.0	5.6	4.8	6.3

IVDMD% = Invitro Dry Matter Digestibility
NDF% = Neutral Detergent Fiber
ADF% = Acid Detergent Fiber
RFV = Relative Feed Value

Table 23. Oat / Field Pea Forage Trial – Pennington County (Wall), 2006

Treatment	Moisture %	Yield Ton/A 13%	% Crude Protein	NDF %	ADF %	RFV
Full Arvika	74	2.02	16.1	42.3	31.2	145
Full Oat	66	**2.89**	11.1	62.9	37.0	89
Full Arvika / Full Oat	68	**2.79**	12.3	58.6	36.2	97
Full Arvika / ½ Oat	72	2.16	14.9	49.3	32.8	123
Full Arvika / ¼ Oat	72	2.09	14.6	51.1	33.6	115
½ Arvika / Full Oat	66	**2.87**	12.2	57.9	35.1	99
½ Arvika / ½ Oat	69	2.33	12.6	55.7	33.5	106
½ Arvika / ¼ Oat	70	1.98	12.3	53.3	33.9	111
Average	70	2.39	13.3	53.9	34.2	110
LSD (P=.05)	3	0.38	1.9	7.5	3.7	23.5
CV	2.6	10.7	9.6	9.5	7.5	14.5

Table 24. Oat / Field Pea Forage Trial, Three Year Summary, 2004-2006.

Treatment	Moisture %	Yield Ton/A 13%	% Crude Protein	IVDMD %	NDF %	ADF %	RFV
Full Arvika	75	1.39	18.8	68.6	34.5	30.4	182
Full Oat	65	**2.04**	12.4	63.4	48.0	41.1	110
Full Arvika / Full Oat	64	**1.99**	13.7	61.7	46.0	39.5	115
Full Arvika / ½ Oat	67	1.80	14.9	65.5	42.1	37.1	128
Full Arvika / ¼ Oat	70	1.58	17.0	68.1	40.7	35.7	137
½ Arvika / Full Oat	65	**2.00**	12.6	65.0	47.3	40.3	110
½ Arvika / ½ Oat	68	1.78	13.1	65.6	46.6	37.8	115
½ Arvika / ¼ Oat	70	1.53	14.7	66.0	43.3	37.1	126
Average	68	1.76	14.6	65.5	43.5	37.4	128
LSD (P=.05)	3	0.18	1.1	0.9	3.2	2.1	12
CV	5.4	12.5	9.3	4.8	8.9	6.9	11.9

IVDMD% = Invitro Dry Matter Digestibility
NDF% = Neutral Detergent Fiber
ADF% = Acid Detergent Fiber
RFV = Relative Feed Value

COOL AND WARM SEASON ANNUAL FORAGE TRIALS

Objectives: To evaluate warm and cool season crops for forage yield and quality.

Background: Perennial forages provide most of the livestock feed in western South Dakota, a major livestock producing region. The frequent occurrence of drought in the past few years has resulted in shortage of livestock feed, driving a high demand for alternative sources of forages. Annual crops can be of great value in developing a year round forage system. They can be used to provide early grazing before perennials are available, extend the grazing period or increase hay and silage production. Annual crops differ in growth habit and in forage quality. The selection of a particular crop for forage should be based on intended end use. There is a lack of detailed information on yield and quality of some of the forage species.

Procedures: The experiments were conducted at two locations, Wall and Oelrichs in western South Dakota in 2005 and 2006. The experimental design was a randomized complete block with four replications per location. Entries were planted in six-row plots, 5 ft. wide by 30 ft. long using a John Deere 750 plot drill with 10-inch row spacing. Four center rows were harvested for forage yield determination.

The cool season forage trial had eight entries including oat (Jerry), barley (Haybet), triticale (variety unknown), annual rye grass and forage pea (Arvika) in 2005. Oat, barley and triticale were also grown in a mixture with pea at a seeding rate of 60% of recommended seeding rate for the cereal crop and 40% of the recommended seeding rate for the forage pea. The full seeding rates were 90 Lb/Acre for Arvika peas, 64 Lb/Acre for oat and barley, 72 Lb/Acre for triticale and 20 Lb/Acre for annual rye grass. The trial was planted on April 19, 2005 at Oelrichs and April 6, 2005 at Wall. Harvesting date was June 28, 2005 at Wall and July 5, 2005 at Oelrichs. In 2006, the study had 14 entries (Table 25). The Wall site was top dressed with 80 lb/acre N. The Oelrichs site had 60 lbs of residual N and no additional fertilizer was applied. Planting date was April 13, 2006 at Wall and May 1, 2006 at Oelrichs. Harvesting date was June 28, 2006 at Wall and July 5, 2006 at Oelrichs.

The warm season forage study had eight entries at Wall and six entries at Oelrichs. The entries were three foxtail millets (Golden German, Manta and White Wonder, two Pearl Millets (Tifleaf 3 and Pro Millet), one proso millet (Sunup) and two cowpeas (Victor and Catjang). Seeding rates were 12 Lb/ Acre for foxtail millets and pearl millet, 15 Lb/Acre for proso millet and 60 Lb/Acre for cowpea. The trial was planted on June 6, 2005 at Wall and June 7, 2005 at Oelrichs. White Wonder and Victor cowpea were not grown at Oelrichs. Harvesting date was August 24, 2005 at Wall and August 25, 2005 at Oelrichs. No fertilizer was applied at either location as residual N levels were adequate at both locations, 133 Lb/Acre N at Wall and 94 Lb/Acre N at Oelrichs. In 2006, the study had eight entries (Table 28). At Wall the study was abandoned due to drought. At Oelrichs, the study was planted on June 1, 2006 and harvested on August 15, 2006.

Results and Discussion: In 2006, stand establishment was good at both locations for the cool season forages. Oelrichs had slightly better growing conditions than Wall. The top yield group in terms of forage yield included: Haybet barley, barley/pea (60/40) mixture, spring triticale, and oat/hairy vetch (100/100). In 2005, soil conditions were much drier at Wall than Oelrichs hence growth and forage yield were greater at Oelrichs. At Wall, the highest yielding entry was barley grown as a sole crop yielding significantly greater than all entries except sole oat and the barley/pea mixture. The lowest yielding entries were sole pea and annual rye grass. Forage yield results from Oelrichs in 2005 were not available to report due to harvesting errors. Crude protein and relative feed value (RFV) were improved significantly by adding a legume to the cereal forage in both years.

In 2006, the warm season forages overall, produced less than half of what the cool season forages produced. The trial had a high degree of variability making it difficult to make good recommendations. At Wall, the trial failed due to extensive heat and lack of moisture. Crude protein levels were highest with Tifleaf 3, Golden German, and Producers Pro Millet. Relative feed value) was best with Golden German, Tifleaf 3, and Producers Pro Millet. The top performing group included: Manta (foxtail millet), Sunup (proso millet), and Producers Pro Millet (pearl millet). Three of the entries; Victor (cowpea), SD 1091RR (soybeans) and W3 (pigeon pea) had very poor forage yields. In 2005, forage yields were higher at Oelrichs than at Wall. The highest yielding entries were Golden German, Tifleaf3 and Pro Millet at Wall and Golden German and Pro Millet at Oelrichs. Crude protein was higher at Wall than at Oelrichs. The highest crude protein content was recorded in cowpea entries at both locations. Among grass crops, Tifleaf3 had the highest protein (13.0% at Wall and 10.1% at Oelrichs). Sunup and Manta had lowest protein.

Table 25. Cool Season Forage Trial – Pennington County (Wall), 2006.

Entry	Forage Yield (Ton/Acre @13%)	ADF (%)	NDF (%)	CP (%)	RFV
Pea (Arvika)	2.4	30.1	44.5	18.2	137
Pea (Journey)	2.0	32	50.3	14.8	119
Pea (Carneval)	1.6	31.3	49.5	14.3	125
Chickling Vetch	1.0	29.8	56.1	14.6	109
Hairy Vetch	1.4	28.8	56.8	14.5	108
Oat / Hairy Vetch (100%/100%)	3.8	27.4	55.5	9.2	113
Oat (Troy)	3.4	28	56.6	9.5	111
Oat / Pea (60% Troy / 40% Arvika)	3.5	28.3	55.3	10.6	112
Barley (Haybet)	4.5	31.2	63	7.5	95
Barley/Pea (60%/40%) mixture	4.1	35.4	63	9.2	90
Spring Triticale	4.0	30.6	58.6	8.7	94
Spring Triticale/Pea(60%/40%)	3.6	32.4	62.2	12	106
Spring Wheat (Russ)	3.4	35.7	63.2	7.6	89
Annual Rye Grass	1.7	32.1	62	10.8	96
Mean	2.9	31.0	56.9	11.5	107.0
LSD (0.05)	0.7	5.6	6.4	2.1	19.1
CV (%)	17.3	12.6	7.9	13.0	12.4

Table 26. Cool Season Forage Trial – Fall River County (Oelrichs), 2006

Variety	Forage Yield (Ton/Acre @13%)	ADF (%)	NDF (%)	CP (%)	RFV
Pea (Arvika)	3.4	24.4	33.8	16.5	193
Pea (Journey)	3.1	31.8	43.0	14.7	139
Pea (Carneval)	2.7	28.2	38.2	14.2	162
Chickling Vetch	2.6	26.5	38.4	19.7	165
Hairy Vetch	1.2	25.4	41.1	20.2	157
Oat / Hairy Vetch (100%/100%)	3.8	28.2	53.2	12.1	116
Oat (Troy)	3.7	28.7	53.3	12.2	116
Oat / Pea (60% Troy / 40% Arvika)	3.9	29.8	52.8	12.8	115
Barley (Haybet)	4.5	29.6	56.0	10.6	109
Barley/Pea (60%/40%) mixture	4.4	29.4	55.5	12.7	110
Spring Triticale	4.1	31.6	58.9	12.6	101
Spring Triticale/Pea(60%/40%)	3.6	31.0	55.8	14.3	108
Spring Wheat (Russ)	2.1	28.2	56.5	14.0	109
Annual Rye Grass	1.0	27.1	51.2	17.1	123
Mean	3.2	28.6	49.1	14.6	130
LSD (0.05)	0.7	2.3	3.6	1.9	16.3
CV (%)	14.9	5.8	5.1	9.2	8.7

NDF% = Neutral Detergent Fiber
ADF% = Acid Detergent Fiber
CP% = Crude Protein
RFV = Relative Feed Value

Table 27. Cool Season Forage Trial – Pennington County (Wall), 2005

Entry	Forage Yield (Ton/Acre @ 13%)	Ash (%)	ADF (%)	NDF (%)	CP (%)	IVDMD (%)	RFV
Oat (Jerry)	3.2	9.9	35.5	59.3	13.0	63.2	96
Oat/Pea (60%/40%) mixture	3.1	10.5	34.2	54.4	15.7	66.3	106
Pea (Arvika)	1.8	9.6	30.0	37.2	25.5	72.0	164
Barley (Haybet)	3.8	8.3	36.8	59.0	10.9	63.2	95
Barley/Pea (60%/40%) mixture	3.2	9.3	36.1	57.3	13.0	64.0	99
Triticale	3.1	9.8	38.0	59.8	12.3	64.3	92
Triticale/Pea (60%/40%) mixture	2.8	10.3	35.5	56.6	15.7	68.1	101
Annual Rye Grass	1.8	11.0	35.7	57.5	17.3	63.8	99
Mean	2.8	9.8	35.3	55.1	15.4	66.5	106
LSD (0.05)	0.6	0.9	2.2	4.8	1.7	3.4	--
CV (%)	13.3	4.8	4.3	5.9	7.5	3.5	--

Ash % = Mineral Content
NDF% = Neutral Detergent Fiber
ADF% = Acid Detergent Fiber
CP% = Crude Protein
IVDMD% = Invitro Dry Matter Digestibility
RFV = Relative Feed Value

Table 28. Warm Season Forage Trial – Fall River County (Oelrichs), 2006.

Entry	Forage Yield (Ton/Acre @13%)	ADF (%)	NDF (%)	CP (%)	RFV
Manta (Foxtail Millet)	2.0	33.4	60.4	9.3	96
Golden German (Foxtail Millet)	1.8	27.5	53.3	12.5	118
Sunup (Proso Millet)	2.0	30.6	56.4	9.4	107
Producers Pro Millet (Pearl Millet)	1.8	29.2	54.5	11.0	112
Tifleaf 3 (Pearl Millet)	0.6	28.0	53.8	13.0	115
Victor (Cowpea)	0.4	--	--	--	--
SD 1091RR (Soybean)	0.0	--	--	--	--
W3 (Pigeon Pea)	0.1	--	--	--	--
Mean	19.1	29.9	55.9	10.8	109
LSD (0.05)	n/a	3.0	2.4	2.8	8.8
CV (%)	**40.4**	6.7	2.8	16.8	5.2

NDF% = Neutral Detergent Fiber
ADF% = Acid Detergent Fiber
CP% = Crude Protein
RFV = Relative Feed Value

Table 29. Warm Season Forage Trial – Pennington Count (Wall), 2005.

Entry	Forage Yield (Ton/Acre @13%)	ADF (%)	NDF (%)	CP (%)	RFV
Golden German (Foxtail Millet)	0.8	55.3	26.7	10.4	160
Manta (Foxtail Millet)	0.5	62.1	31.5	8.7	120
White Wonder (Foxtail Millet)	0.7	57.9	27.5	10.2	148
Tifleaf 3 (Pearl Millet)	0.8	57.9	26.6	13	153
Pro Millet (Pearl Millet)	0.7	58.4	27.7	11.6	146
Sunup (Proso Millet)	0.4	58	28.7	9.3	142
Victor (Cowpea)	0.5	35.1	23.3	18.3	246
Catjang (Cowpea)	0.4	36.3	24.6	17.6	229
Mean	0.6	52.6	27.1	12.4	168
LSD	0.2	3.5	2.5	1.4	–
CV (%)	26.3	4.5	6.2	7.7	–

Table 30. Warm Season Forage Trial – Fall River County (Oelrichs), 2005.

Entry	Forage Yield (Ton/Acre @13%)	ADF (%)	NDF (%)	CP (%)	RFV
Golden German (Foxtail Millet)	2.0	63.3	33.9	7.7	109
Manta (Foxtail Millet)	1.6	63.6	34.2	6.2	107
Tifleaf 3 (Pearl Millet)	1.3	59.4	30.7	10.1	129
Pro Millet (Pearl Millet)	1.9	60.3	32.9	7.3	119
Sunup (Proso Millet)	1.6	56.8	31.3	6.1	133
Catjang (Cowpea)	1.0	38.9	27.5	13.9	198
Mean	1.6	57.1	31.8	8.6	132
LSD	0.3	4.2	2.1	1.6	–
CV (%)	12.6	4.8	4.4	12.3	–

NDF% = Neutral Detergent Fiber
ADF% = Acid Detergent Fiber
CP% = Crude Protein
RFV = Relative Feed

WINTER WHEAT STARTER FERTILIZER DEMOSTRATION

Objective: To evaluate the response of winter wheat to different types of starter fertilizer.

Procedure: Plots were seeded at five locations in September 2005 with a John Deere 610 double disk (fallow) or John Deere 750 (no-till) plot drills with 10 inch spacing. The experimental design was a randomized complete block with four replications. The variety Jagalene was planted at 950,000 seeds per acre (60 lb/A). The starter fertilizer treatments were 55 lb/A diammonium phosphate (18-46-0), 55 lb/A triple superphosphate (0-46-0), 30 lb/A ammonium nitrate (34-0-0) and an untreated check. The granular fertilizer treatments were applied directly with the seed. Herbicides were applied in either the fall or spring and varied according to weeds present. Visual stand ratings were taken in October 2005 and April 2006. The plots were trimmed to 5' x 25' after heading. The wheat was harvested in July with a small plot combine. Height, shatter, and lodging notes were taken at the time of harvest. Protein content was determined with a Near Infrared Spectrophotometer (Technicon InfraAlyzer 400). The trials were planted next to the winter wheat variety trials. Information on planting and harvest dates can be found on pages 7 and 11.

Summary: Only the Bison location showed any response to starter fertilizer. At Oelrichs the two treatments with phosphorus showed increased yields. Past years have shown positive responses to phosphorus starter, but as typical with phosphorus results can be variable, especially if soil levels are adequate.

Location Summaries:

Locations not Harvested

Location	Reason
Pennington County – Scenic	Liquid starter accidentally applied to all treatments
Stanley County - Hayes	Drought
Lyman County – Kennebec	Drought

Table 31. Winter Wheat Starter Fertilizer Trial – Fall River County (Oelrichs), 2006.

Variety	Height	Lodging	Test Wt	Yield	Protein
	Inches	1-9*	Lb/Bu	Bu/A	Percent
Check	29	0	62.2	54.9	10.2
55 lb/A 18-46-0 (diammonium phosphate)	30	0	62.2	63.3	10.1
55 lb/A 0-46-0 (triple superphosphate)	30	0	62.2	63.2	9.7
30 lb/A 34-0-0 (ammonium nitrate)	29	0	62.0	55.5	11.9
Average	29.3	0.0	62.1	59.2	10.5
LSD (P=.05)	1.8	0.0	0.5	**NS****	
CV	2.0	0.0	0.5	10.7	
				(Lb/A)	
Soil Test Recommendations	OM%	pH	N	P	K
	1.9	7.1	90	30	0

* 0=No lodging, 9 = 100% lodged.

** No statistical difference in yield among treatments.

Table 32. Winter Wheat Starter Fertilizer Trial – Bennett County (Martin), 2006.

Variety	Height	Lodging	Test Wt	Yield	Protein
	Inches	1-9*	Lb/Bu	Bu/A	Percent
Check	27	0	63.2	47.0	13.0
55 lb/A 18-46-0 (diammonium phosphate)	26	0	62.8	50.0	13.1
55 lb/A 0-46-0 (triple superphosphate)	26	0	61.7	46.7	12.0
30 lb/A 34-0-0 (ammonium nitrate)	26	0	62.9	45.2	12.9
Average	26.1	0.0	62.7	47.2	12.8
LSD (P= 05)	2.9	0.0	2.7	**NS****	
CV	5.6	0.0	2.1	6.2	
				(Lb/A)	
Soil Test Recommendations	OM%	pH	N	P	K
	2.3	6.8	85	20	0

* 0=No lodging, 9 = 100% lodged.
** No statistical difference in yield among treatments.

Table 33. Winter Wheat Starter Fertilizer Trial – Meade County (Sturgis), 2006.

Variety	Height	Lodging	Test Wt	Yield	Protein
	Inches	1-9*	Lb/Bu	Bu/A	Percent
Check	24	0	62.0	25.9	10.5
55 lb/A 18-46-0 (diammonium phosphate)	24	0	62.6	32.2	10.0
55 lb/A 0-46-0 (triple superphosphate)	22	0	62.2	27.8	9.8
30 lb/A 34-0-0 (ammonium nitrate)	23	0	63.5	30.3	9.3
Average	22.9	0.0	62.6	29.1	9.9
LSD (P= 05)	3.8	0.0	3.9	13.4	
CV	5.3	0.0	3.1	**23.0**	
				(Lb/A)	
Soil Test Recommendations	OM%	pH	N	P	K
	**				

* 0=No lodging, 9 = 100% lodged.
** No soil test taken at Sturgis due to dry, hard soil.

Table 34. Winter Wheat Starter Fertilizer Trial – Perkins County (Bison), 2006.

Variety	Height	Lodging	Test Wt	Yield	Protein
	Inches	1-9*	Lb/Bu	Bu/A	Percent
Check	18	0	**	13.5	13.6
55 lb/A 18-46-0 (diammonium phosphate)	18	0	65.4	**17.0**	15.1
55 lb/A 0-46-0 (triple superphosphate)	18	0	63.1	**15.7**	14.5
30 lb/A 34-0-0 (ammonium nitrate)	18	0	**	12.2	14.1
Average	17.8	0.0	47.9	14.6	14.3
LSD (P=.05)	2.4	0.0		3.0	
CV	8.6	0.0		12.8	
				(Lb/A)	
Soil Test Recommendations	OM%	pH	N	P	K
	2.9	6.8	55	15	0

* 0=No lodging, 9 = 100% lodged.
** Not enough sample for a test weight.

ROTATIONAL IMPACTS OF BROADLEAF CROPS ON WINTER WHEAT

Objectives:

1) To determine the performance and yield of winter wheat planted on five different types of crop stubbles

Procedures: The experiment was conducted at two locations in western South Dakota (Wall-medium textured soils and Hayes -heavy textured soils). The trial was managed using minimum tillage practices. The design of the experiment included growing broadleaf crops (field pea, chickpea, lentil and safflower) and spring wheat in year 1. Blocks of spring wheat (Walworth), dry peas (Arvika), Lentils (Richlea), Chickpeas (Dwelly) and Safflower (Finch) were planted on April 25, 2005. All blocks were planted with a 5 foot research JD 750 no-till drill. The spring wheat (Walworth) received 6 gallons per acre of liquid 10-34-0 at planting time. The safflower (Finch) received 3 gallons per acre of liquid 10-34-0 at planting time. The three pulse crops were not fertilized at planting time. The dry peas, lentils, chickpeas, and safflower blocks were sprayed with Spartan at 4 oz / Acre rate with 10 gpA spray rate of water on May 2, 2005. These crops were established at the two locations in the spring of 2005. In the fall of 2005 each broadleaf crop plots was recropped to winter wheat. Before planting winter wheat, soil samples were collected from different crop stubbles to determine nutrient status. Soil moisture measurements to a depth of 48 inches were taken from different crop stubbles before planting winter wheat. Winter Wheat (cv. Expedition) was seeded on September 26, 2005 at both locations (Hayes and Wall). The wheat crop was planted with a JD 750 drill at 950,000 seeds per acre with liquid starter fertilizer (10-34-0) added at 6 gallons / acre. Soil moisture and nutrient sampling was done on September 27, 2005 at both locations. At Wall, the Expedition stand was good in the fall but the crop did not receive much moisture during the winter or the following spring. This trial was harvested on July 25, 2006. Performance of winter wheat was evaluated by measuring plant height, number of heads per square foot, number of kernels per head, number of seeds per pound, grain yield, test weight and grain protein.

Results and Discussion: Results are presented on Tables 35 to 39. At Hayes, the experiment was abandoned due to drought. At Wall, winter wheat grown after spring wheat and lentil had the best yields. Winter wheat grown after safflower had the lowest yield. It was a particularly dry year so there was very limited soil moisture. Table 38 shows that spring wheat and lentil stubble had relatively more moisture than other stubbles. This was due to the fact that the two crops had poor stands and therefore used less moisture compared to other broadleaf crops. Safflower dried the soil the most.

The effect of previous crop was also significant for grain protein and test weight. Test weight was greatest on spring wheat stubble and lowest on chickpea stubble. Winter wheat grown after safflower had the highest grain protein while winter wheat grown after spring wheat had the lowest grain protein.

Table 35. Broadleaf and Spring Wheat Crop Yields at Wall and Hayes -2005.

Location	Dry peas	Chickpeas	Spring Wheat	Lentils	Safflower
Wall	215 lbs / A	253 lbs / A	8.0 bu / A	31 lbs / A	13 lbs / A
Hayes	900 lbs / A	509 lbs / A	7.7 bu / A	None	221 lbs / A

Table 36. Nutrient Analysis at the Wall location, November 17, 2005.

Previous Crop	Texture Class	pH	Soluble Salts mmho / cm	O. M. %	NO3-N Lbs / A (0-24")	Phosphorus Lbs / Acre	Potassium Lbs / Acre
Chickpea	Medium	6.9	0.7	1.9	19	26	842
Dry pea	Medium	7.7	0.7	1.6	26	12	576
S. Wheat	Medium	7.2	0.8	1.6	19	22	682
Lentil	Medium	7.1	0.7	1.9	30	26	658
Safflower	Medium	7.2	0.7	1.8	23	24	702

Table 37. Soil Nutrient Analysis at the Hayes Location as of November 17, 2005.

Previous Crop	Texture Class	pH	Soluble Salts mmho / cm	O. M. %	NO3-N Lbs / A (0-24")	Phosphorus Lbs / Acre	Potassium Lbs / Acre
Chickpea	Medium	7.7	1.7	2.0	27	12	928
Dry pea	Medium	7.2	1.0	1.9	55	26	940
S. Wheat	Medium	7.9	1.4	2.4	42	16	1292
Lentil	Medium	7.6	1.7	2.1	48	22	1008
Safflower	Medium	7.7	1.2	1.9	27	10	1362

Table 38. Soil Moisture (%) Values by Previous Crop Prior to Planting Winter Wheat (September 27, 2005).

Previous Crop	Soil Depth In Inches	Soil Moisture %
Spring Wheat In 2005	0-12	11.1
	12-24	11.7
	24-36	10.6
	36-48	10.1
Mean		10.8%
Dry Pea in 2005	0-12	8.8
	12-24	9.5
	24-36	8.2
	36-48	8.8
Mean		8.8%
Lentil in 2005	0-12	10.4
	12-24	11.1
	24-36	8.9
	36-48	8.7
Mean		9.7%
Chickpea in 2005	0-12	8.9
	12-24	8.0
	24-36	8.0
	36-48	7.6
Mean		8.1%
Safflower in 2005	0-12	8.3
	12-24	8.4
	24-36	7.6
	36-48	7.3
Mean		7.9%

Table 39. Effect of Previous Crop on Performance of Winter Wheat at Wall - 2006

Previous Crop	Protein (%)	Test Wt. (Lbs/bu)	Yield (Bu/A)
Spring Wheat	13.8	61.0	15.2
Dry Peas	14.6	58.9	12.1
Lentils	13.9	59.2	15.7
Chickpeas	14.0	58.3	13.5
Safflower	16.0	59.8	10.3
Mean	14.4	59.4	13.3
LSD (0.05) =	n/a	1.6	1.8
CV =	n/a	1.7	8.7

SAFFLOWER SEEDING RATE STUDY

Objective: To evaluate the response of conventional and hybrid safflower to different seeding rates.

Procedure: Safflower was planted in a factorial (variety x seeding rate) experiment with four replications near Wall, South Dakota. The conventional variety Finch and the hybrid 014C were planted at 50 000, 100 000, 150 000, 200 000, 250 000 and 300 000 seeds/A, equivalent to 5, 10, 15, 20, 25 and 30 pounds/A. Prowl H2O (3 pints/A) was applied for weed control and the trial was planted on May 4th with a John Deere 750 research drill. Liquid starter fertilizer (3 gal/A10-34-0) was applied at 4 lbs N and 13 lbs P_2O_5 per acre with the seed. The safflower was harvested for grain on September 5th with a Wintersteiger small plot combine. The results are given in Tables 40 and 41.

Summary: This study was undertaken to see if hybrid safflower could be planted at lower seeding rates than conventional varieties. Lower seeding rates would offset some of the cost of the higher priced hybrid seed. From these trials it appears that 150,000 seeds/acre (15 lb/A) maximized yield for both the conventional type and the hybrid. The hybrid at low rates did yield significantly better than Finch, but planting at higher rates also increased 014C's yields. Higher seeding rates did slightly decrease plant height, but had little effect on test weight or oil content. So this study suggested that the 150,000 seeds/acre (15 lb/acre) would be the recommended rate for both types.

Table 40. Safflower Seeding Rate Study – Pennington County (Wall) 2006.

Treatment	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Yield Bu/A	Oil Percent
Variety					
Finch	18.8	0	42.4	1201	34.6
014C hybrid	20.1	0	40.7	**1310**	34.0
LSD (P=.05)	0.7	NS	0.7	45	--
Seeding Rate (seeds/acre)					
50,000 (5 Lb)	20.6	0	40.2	1045	33.8
100,000 (10 Lb)	20.6	0	41.6	1237	34.7
150,000 (15 Lb)	19.3	0	42.3	**1329**	34.5
200,000 (20 Lb)	18.8	0	41.2	1250	33.8
250,000 (25 Lb)	19.0	0	42.3	**1302**	34.9
300,000 (30 Lb)	18.5	0	41.7	**1368**	34.4
LSD (P=.05)	1.2	NS	1.2	79	--
Variety x Seeding Rate					
Finch 50,000	20.3	0	41.3	993	33.9
Finch 100,000	20.0	0	42.5	1228	35.3
Finch 150,000	18.3	0	43.2	**1281**	35.3
Finch 200,000	18.3	0	41.7	1185	34.0
Finch 250,000	18.5	0	43.1	1246	34.4
Finch 300,000	17.8	0	42.7	**1272**	34.8
014C hybrid 50,000	21.0	0	39.1	1098	33.6
014C hybrid 100,000	21.3	0	40.8	1246	34.0
014C hybrid 150,000	20.3	0	41.3	**1376**	33.6
014C hybrid 200,000	19.3	0	40.7	**1316**	33.6
014C hybrid 250,000	19.5	0	41.6	**1359**	35.4
014C hybrid 300,000	19.3	0	40.6	**1464**	33.9
LSD (P=.05)	1.7	0.0	1.7	111	--
Average	19.5	0.0	41.6	1255	34.3
CV	6.1	0.0	2.9	6.2	--

* 0=No lodging, 9 = 100% lodged.

Table 41. Safflower Seeding Rate Study – Pennington County (Wall) 2005.

Treatment	Height Inches	Lodging 0-9*	Test Wt Lb/Bu	Yield Bu/A	Oil Percent
Variety					
Finch	22	0	42.2	727	35.7
014C hybrid	23	0	42.1	1053	33.8
LSD (P=.05)	0.5	NS	NS	90	–
Seeding Rate (seeds/acre)					
50,000 (5 Lb)	23	0	42.5	658	33.7
100,000 (10 Lb)	23	0	40.6	832	35.3
150,000 (15 Lb)	23	0	44.0	1067	34.9
200,000 (20 Lb)	22	0	41.2	867	35.1
250,000 (25 Lb)	22	0	42.2	950	34.5
300,000 (30 Lb)	23	0	41.9	967	35.1
LSD (P=.05)	NS	NS	1.2	156	–
Variety x Seeding Rate					
Finch 50,000	23	0	**	479	34.9
Finch 100,000	23	0	39.2	645	35.5
Finch 150,000	21	0	44.0	1019	35.9
Finch 200,000	22	0	**	680	36.3
Finch 250,000	21	0	43.3	749	35.5
Finch 300,000	21	0	42.2	793	36.3
014C hybrid 50,000	23	0	42.5	836	32.4
014C hybrid 100,000	23	0	42.1	1019	35.1
014C hybrid 150,000	24	0	44.0	1115	33.9
014C hybrid 200,000	23	0	41.2	1054	33.8
014C hybrid 250,000	24	0	41.1	1150	33.5
014C hybrid 300,000	24	0	41.6	1141	33.8
LSD (P=.05)	NS	NS	1.7	NS	–
Average	22.5	1.0	42.1	890	34.7
CV	3.5	0.0	4.1	17.2	–

*0=No lodging, 9=100% lodged.
** Not enough sample for a test weight.

SAFFLOWER PLANTING DATE STUDY

Objectives:

1) To evaluate the effect of delayed planting on the yield, test weight and oil content of safflower.
2) To determine if the leaf spotting disease Alternaria can be lessened by delaying planting.

Procedures: Safflower was planted in a factorial (varieties x planting date) experiment with four replications near Wall, South Dakota on May 4, May 17, and June 6, 2006. The herbicide Prowl H2O (3 pints/A) was applied on May 5, 2006 to control weeds. Four varieties of safflower (Finch, S-541, S-518, and Montola 2003) were seeded at 210,000 seeds per acre rate with a John Deere 750 research drill. The ground was black fallow the previous year and soil tests called for no additional nitrogen. Starter fertilizer at 6 gallons per acre of liquid ammonium phosphate (10-34-0) was applied with the seed at planting time. All 3 planting dates were harvested on September 5, 2006. Results of the 2002 – 2006 trials are shown in Tables 40 – 44.

Discussion: Overall, in the 5 years that this trial has been planted, there was some yield variability but generally, planting from mid-April to the first week of May gave us the best yields. Test weights were variable but tended to drop off in late May and June planting dates. Alternaria was not a problem the past five years because of the drought conditions we have been in since 2002. Average oil content stayed very consistent from year to year at 37-38%.

In 2006 (Table 41), we saw decent early spring moisture. The summer turned very hot with temperatures well over 100 degrees. There was no alternaria pressure because it was so dry. Yields were the best at the first planting date (May 4). Yields were significantly better with all varieties but Montola 2003 at the first planting date. Yields dropped drastically as we planted later on June 5th. Test weights dropped sharply in the June planting date. Oil contents remained fairly consistent through out all planting dates

In 2005 (Table 42), because of wet conditions, the April 15th date was not planted, so only three dates were planted in 2005. Lack of precipitation has been the major factor limiting safflower yields the past four years. In 2005, there was limited stored soil moisture combined with limited summer rainfall limiting yeilds to 900 Lb/A. The 2005, analysis (Table 41) shows no significant difference in yield for the planting dates.

In 2004 (Table 43), there was virtually no rain in April and early May. This combined with dry topsoil conditions caused the first three dates to germinate and emerge at the same time. So effectively there was only two planting dates in 2004, May 14 and May 27. What we have seen over the past four years is that plant height and test weight decreased with later planting dates, but yield trends have varied over the years. Leaf infection from Alternaria has not been a factor the past four years due to the dry summers that have limited the amounts of dewy conditions that promote infection.

Table 42. Safflower Planting Date Trial – Pennington County (Wall) 2006

Treatment	Test Wt Lb/Bu	Yield Lb/A	Oil Percent
Planting Date			
May 4	39.8	**1117**	36.5
May 17	40.4	971	37.8
June 5	36.4	797	37.5
LSD (P=.05)	1.8	80	n/a
Variety			
Finch	39.9	979	35.0
S-541	33.8	738	39.9
S-518	36.8	**1124**	37.8
Montola 2003	40.0	1008	37.2
LSD (P=.05)	2.1	92	n/a
Variety x Planting Date			
Finch May 4	40.9	**1176**	33.1
Finch May 17	43.1	1002	36.1
Finch June 5	35.6	758	35.8
S-541 May 4	40.6	967	39.3
S-541 May 17	38.7	714	40.6
S-541 June 5	22.3	531	—
S-518 May 4	37.3	**1281**	37.1
S-518 May 17	39.2	1115	37.8
S-518 June 5	33.9	976	38.5
Montola 2003 May 4	40.4	1045	36.8
Montola 2003 May 17	40.6	1054	36.8
Montola 2003 June 5	38.9	923	38.2
LSD (P=.05)	3.7	160	n/a
Average	37.6	961	37.2
CV	7.8	11.5	n/a

Table 43. Safflower Planting Date Trial – Pennington County (Wall) 2005.

Treatment	Height Inches	Lodging 1-9*	Test Wt Lb/Bu	Yield Lb/A	Oil Percent
Planting Date					
April 29	20	1	39.8	904	37.8
May 18	18	1	41.3	917	36.8
June 6	16	1	42.3	941	
LSD (P=.05)	1.3	NS	1.1	NS	--
Variety					
Finch	19	1	43.2	880	35.5
S-541	19	1	40.6	921	38.7
S-518	17	1	38.9	1086	37.9
Montola 2003	17	1	41.8	796	37.2
LSD (P=.05)	NS	NS	NS	NS	--
Variety x Planting Date					
Finch April 29	20	1	41.3	854	35.9
Finch May 18	18	1	43.6	897	35.0
Finch June 6	18	1	44.7	889	
S-541 April 29	21	1	39.8	854	38.9
S-541 May 18	19	1	40.6	923	38.4
S-541 June 6	16	1	41.4	984	
S-518 April 29	18	1	38.1	1098	39.0
S-518 May 18	16	1	38.1	1037	36.8
S-518 June 6	15	1	40.6	1124	
Montola 2003 April 29	20	1	40.3	941	
Montola 2003 May 18	17	1	41.9	854	
Montola 2003 June 6	15	1	41.0	932	
LSD (P=.05)	2.5	NS	2.3	NS	--
Average	18	1	40.9	921	37.3
CV	11.3	0.0	5.9	17.4	--

Table 44. Safflower Planting Date Trial – Pennington County (Wall) 2004.

Treatment	Height	Lodging	Test Wt	Yield	Flowering Date	Oil
	Inches	1-9*	Lb/Bu	Lb/A	50% Bloom	Percent
Planting Date						
April 14	23	1	44.3	1549	July 24	39.1
April 28	24	1	44.0	1629	July 24	38.8
May 11	24	1	43.6	1699	July 24	38.6
May 25	19	1	42.1	1531	Aug 8	37.3
LSD (P=.05)	0.8	NS	0.8	NS	--	--
Variety						
Finch	23	1	46.2	1405	July 27	35.9
S-541	22	1	43.4	**1708**	July 27	38.8
S-518	22	1	40.6	**1788**	July 28	38.5
Montola 2003	22	1	43.8	1507	July 28	37.8
LSD (P=.05)	0.8	NS	0.8	143	--	--
Variety x Planting Date						
Finch April 14	24	1	46.8	1472	July 24	36.0
Finch April 28	24	1	45.6	1376	July 24	35.7
Finch May 11	23	1	47.3	1411	July 24	36.3
Finch May 25	21	1	44.9	1359	August 7	35.4
S-541 April 14	22	1	43.7	1664	July 24	41.4
S-541 April 28	24	1	44.9	1716	July 24	41.3
S-541 May 11	25	1	43.4	1795	July 24	40.8
S-541 May 25	19	1	41.5	1655	August 7	39.7
S-518 April 14	23	1	41.5	1751	July 24	39.8
S-518 April 28	25	1	41.3	1786	July 24	39.6
S-518 May 11	24	1	40.6	1934	July 24	39.0
S-518 May 25	18	1	39.0	1681	August 9	38.4
Montola 2003 April 14	23	1	45.1	1307	July 24	39.0
Montola 2003 April 28	23	1	44.3	1638	July 24	38.7
Montola 2003 May 11	23	1	43.2	1655	July 24	38.1
Montola 2003 May 25	19	1	42.9	1429	August 9	37.8
LSD (P=.05)	NS	NS	NS	NS	--	--
Average	22	1.0	43.5	1601	--	38.6
CV	4.8	0.0	2.5	12.5	--	--

Table 45 Safflower Planting Date Trial – Pennington County (Wall) 2003.

Treatment	Height	Lodging	Test Wt	Yield	Flowering Date	Oil
	Inches	1-9*	Lb/Bu	Lb/A	50% Bloom	Percent
Planting Date						
April 14	22	1	40.4	**560**	July 14	35.7
April 28	20	1	41.9	444	July 20	38.2
May 11	19	1	41.9	413	July 24	36.5
May 25	17	1	39.8	372	July 28	36.9
LSD (P=.05)	1.2	NS	1.1	60	--	--
Variety						
Finch	20	1	41.7	**443**	July 21	33.4
S-541	21	1	41.2	**456**	July 21	39.1
S-518	19	1	39.8	**494**	July 21	38.8
Montola 2003	18	1	41.3	396	July 22	36.3
LSD (P=.05)	1.2	NS	1.1	60	--	--
Variety x Planting Date						
Finch April 14	22	1	41.5	530	July 15	33.1
Finch April 28	21	1	42.3	478	July 18	35.1
Finch May 11	20	1	42.4	388	July 23	31.0
Finch May 25	18	1	40.5	375	July 28	34.4
S-541 April 14	23	1	39.7	570	July 14	36.4
S-541 April 28	22	1	43.0	430	July 20	40.4
S-541 May 11	20	1	42.2	467	July 24	39.4
S-541 May 25	18	1	39.8	357	July 28	40.0
S-518 April 14	22	1	39.7	610	July 14	39.2
S-518 April 28	20	1	40.2	529	July 20	40.0
S-518 May 11	17	1	40.4	412	July 24	38.6
S-518 May 25	16	1	39.1	426	July 27	37.5
Montola 2003 April 14	20	1	40.6	530	July 14	34.4
Montola 2003 April 28	18	1	42.3	338	July 20	37.5
Montola 2003 May 11	18	1	42.6	385	July 24	37.3
Montola 2003 May 25	16	1	39.6	330	July 27	36.0
LSD (P=.05)	NS	NS	NS	**NS**	--	--
Average	19.2	1.0	41.0	447	--	36.9
CV	8.5	0.0	3.8	19.1	--	--

Table 45. Safflower Date of Planting Trial –Pennington County (Wall) 2002

Treatment	Height	Lodging	Test Wt	Yield	Flowering Date	Oil
	Inches	1-9*	Lb/Bu	Lb/A	50% Bloom	Percent
Planting Date						
April 23	17	1	42.3	496	July 10	35.7
May 6	15	1	43.0	**640**	July 15	38.2
May 21	13	1	42.6	**643**	July 18	36.5
June 4	11	1	43.3	570	July 31	36.9
LSD (P= 05)	0.7	NS	0.6	70	--	--
Variety						
Finch	14	1	43.4	**658**	July 18	36.7
S-541	14	1	42.8	**655**	July 17	37.0
Montola 2003	14	1	42.2	448	July 20	39.3
LSD (P=.05)	NS	NS	0.5	61	--	--
Variety x Planting Date						
Finch April 23	18	1	42.8	552	July 11	37.5
Finch May 6	15	1	43.5	756	July 14	37.3
Finch May 21	13	1	43.5	690	July 17	35.4
Finch June 4	12	1	43.8	635	July 30	36.6
S-541 April 23	18	1	42.3	598	July 10	37.6
S-541 May 6	15	1	43.0	739	July 14	37.8
S-541 May 21	13	1	43.0	702	July 17	36.3
S-541 June 4	12	1	42.9	582	July 30	36.3
Montola 2003 April 23	17	1	41.8	338	July 10	38.5
Montola 2003 May 6	15	1	42.5	424	July 18	39.4
Montola 2003 May 21	13	1	41.3	536	July 20	38.8
Montola 2003 June 4	11	1	43.1	492	August 3	40.7
LSD (P=.05)	NS	NS	NS	NS	--	--
Average	14.1	1.0	42.8	587	--	37.7
CV	5.9	0.0	1.6	14.3	--	--

FIELD PEA SEEDING RATE x VARIETY STUDY – 2004 to 2006

Objectives: To evaluate the response of normal and semi-leafless field pea varieties to six seeding rates.

Procedures: Considering the high cost of field pea seed, proper plant populations are important for optimizing yield and economic returns. A variety and seeding rate study was conducted at two locations (Wall and Hayes) in western South Dakota. Four field pea varieties, two semi-leafless and the other two normal-leaf were planted at six seeding rates on during the first week of April in 2004, 2005 and 2006. The semi-leafless varieties were Carneval and CDC Mozart. Carneval is an older semi-leafless variety that was popular in South Dakota, whereas CDC Mozart is a variety from Saskatchewan, Canada which has shown good potential under western South Dakota conditions. The normal leaf variety Grande was chosen because its good yield record in western South Dakota. The other normal leaf variety Arvika, was chosen because it produces high biomass and is a forage variety.

Pea variety	Leaf type	Seed color/Use
Arvika	normal leaf	Mottled/Forage
Grande	normal leaf	Yellow/Grain/Forage
Carneval	semi-leafless	Yellow/Grain
CDC Mozart	semi-leafless	Yellow/Grain

Seeding rates for each variety were adjusted to give 100,000, 150,000, 200,000, 250,000, 300,000 and 350,000 live seeds per acre. The recommended seeding rate is 300,000 viable seeds per acre. The experimental design was a randomized complete block with treatments arranged in a factorial design. Treatments were replicated four times. Measurements taken include plant height, biomass at harvest, pod and seed production, seed yield, and harvest index. Harvest index is a measure of the ratio of grain weight to total plant weight. No nitrogen fertilizer was applied to the plots. Granular pea inoculant was placed with the seed into the furrow. Spartan was applied at both locations prior to planting to control weeds.

Table 47. Seeding Rate and Final Plant Population in 2004 and 2006.

Seeding Rate (Seeds / A)	2004 Plants / Acre (% stand)	2006 Plants / Acre (% stand)	Average Final Plant Population
Wall			
100 000	118404 (118%)	85997 (86%)	**102065 (102%)**
150 000	186461 (124%)	119890 (80%)	**153175 (102%)**
200 000	220363 (110%)	162889 (81%)	**191626 (96%)**
250 000	275517 (110%)	222834 (89%)	**249175 (99%)**
300 000	296516 (99%)	240540 (80%)	**268528 (90%)**
350 000	333454 (95%)	290874 (83%)	**312164 (89%)**
Hayes			
100 000	109549 (110%)	85238 (85%)	**97393** (97%)
150 000	142692 (95%)	134307 (90%)	**138499** (92%)
200 000	171028 (86%)	169718 (85%)	**170373** (85%)
250 000	229471 (92%)	229917 (92%)	**229694** (92%)
300 000	303600 (101%)	233964 (78%)	**268782** (90%)
350 000	322069 (92%)	285562 (82%)	**303815** (87%)

Results and Discussion: The effect of seeding rate on plant height, number of pods per plant, number of seeds per plant, harvest index and grain yield at Wall are presented in Tables 48 and 49. At Wall, yield increased as seeding rate increased with the highest yield recorded at the seeding rate of 350,000 seeds/A but with no significant differences between the three top seeding rates. Results have shown that when seeding rates were low, field pea plants produced more pods and more seeds per plant to compensate for the lower plant populations. The variety CDC Mozart had the highest yield at Wall while the variety Carneval had the lowest yield.

In the drier environment at Hayes, (Tables 50 and 51) yields were low and the response to seeding rate was limited. The highest yield was observed at the 350,000 seeding rate but this yield was not significantly higher than the yield at 250,000 seeds per acre. Although lower populations produced more pods per plant and more seeds per pod, soil moisture limited the extent of this plasticity.

The response to seeding rate was generally the same for normal leaf and semi-leafless varieties at both locations. With adequate space, moisture, and nutrients; field pea will compensate for lower plant density through branching and heavier pod set. Various studies on dry peas indicate that normal-leaf varieties are more 'plastic' than semi-leafless varieties. The dry conditions experienced in all three years may have limited the 'plasticity' of pea varieties. In 2005, plant counts were taken at later growth stages making it very difficult to distinguish single plants and confounding results. Plant count data for 2005 are therefore not reported. We observed higher weed pressure where plant populations were lower than 200,000 seeds/A at Hayes and this should be taken into consideration when deciding on seeding rates.

Table 46. Pods/Plant, Seeds/ Pod, Height, Harvest Index, and Yield of Field Pea at Wall in 2004-2006.

Treatment	# of Pods / Plant	# of Seeds / Pod	Height (inches)	Harvest Index	Yield (Lbs/A)
Seeding Rate (Seeds / A)					
100 000	8.4	4.8	25.7	.42	1025
150 000	7.7	4.6	25.6	.40	1146
200 000	6.6	4.5	25.8	.40	1209
250 000	6.4	4.2	25.1	.39	1305
300 000	5.7	4.3	26.1	.39	1336
350 000	5.5	4.1	24.9	.38	1363
LSD (0.05)	**.8**	**.3**	**1.1**	**.01**	**198**
Variety					
Arvika	6.2	5.2	34.1	.37	1307
Grande	6.6	3.8	26.3	.41	1227
Carneval	6.6	4.6	22.1	.36	1080
CDC Mozart	7.5	4.1	19.8	.45	1309
LSD (0.05)	**.6**	**.2**	**.9**	**.01**	**160**
CV(%)	**25.0**	**11.7**	**15.9**	**8.8**	**26.1**

Table 49. Number of pods/plant, Number of seeds/pod, Plant Height, Harvest Index, and Yield of Field Pea at Wall in 2006.

Treatments	No. of Pods / Plant	No. of Seeds / Pod	Height (inches)	Harvest Index	Yield (Lbs/A)
Seeding Rate (Seeds / A)					
100 000	8.6	4.3	22.7	.47	1146
150 000	7.6	4.4	23.0	.45	1243
200 000	6.4	4.3	22.5	.46	1336
250 000	6.2	4.2	23.0	.44	1395
300 000	4.7	4.3	22.7	.43	1427
350 000	4.6	4.0	22.5	.42	1445
LSD (0.05)	**1.1**	**.3**	**1.1**	**.01**	**124**
Variety					
Arvika	5.7	4.9	30.7	.38	1404
Grande	6.6	3.7	22.9	.47	1353
Carneval	6.1	4.5	20.6	.44	1217
CDC Mozart	7.0	3.9	16.6	.50	1354
LSD (0.05)	**.9**	**.2**	**.9**	**.01**	**101**
CV (%)	**24.9**	**11.3**	**7.4**	**5.3**	**13.2**

Table 50. Number of Pods/Plant, Number of Seeds/ Plant, Plant Height, Harvest Index, and Yield of Field Pea at Hayes in 2004-2006.

Treatments	No. of Pods / Plant	No. of Seeds / Pod	Height (inches)	Harvest Index	Yield (Lbs/A)
Seeding Rate (Seeds / A)					
100 000	5.7	4.6	19.7	.45	537
150 000	5.1	4.6	19.3	.45	666
200 000	4.6	4.4	20.1	.46	692
250 000	4.4	4.5	18.8	.45	713
300 000	4.1	4.2	19.1	.46	767
350 000	3.9	4.2	18.5	.46	769
LSD (0.05)	**.6**	**.2**	**1.2**	**.03**	**73**
Variety					
Arvika	4.3	5.1	26.1	.40	749
Grande	5.4	3.9	19.6	.47	737
Carneval	4.2	4.6	17.1	.44	611
CDC Mozart	4.8	4.1	14.2	.51	666
LSD (0.05)	**.5**	**.2**	**1.0**	**.03**	**60**
CV(%)	**25.0**	**11.7**	**15.9**	**8.8**	**26.1**

Table 51. Number of Pods/Plant, Number of Seeds/ Plant, Plant Height, Harvest Index and Yield of Field Pea at Hayes in 2006.

Treatments	No. of Pods / Plant	No. of Seeds / Pod	Height (inches)	Harvest Index	Yield (Lbs/A)
Seeding Rate (Seeds / A)					
100 000	5.2	4.3	20.1	.44	554
150 000	4.3	4.5	19.8	.46	691
200 000	3.7	4.2	20.0	.47	741
250 000	3.4	4.4	17.8	.47	758
300 000	2.9	4.0	19.0	.45	800
350 000	2.7	4.0	17.5	.45	786
LSD (0.05)	**.5**	**.3**	**1.2**	**.01**	**62**
Variety					
Arvika	3.1	4.9	25.0	.33	724
Grande	4.5	3.7	19.0	.49	778
Carneval	3.3	4.6	18.2	.47	687
CDC Mozart	3.9	3.7	13.9	.54	698
LSD (0.05)	**.4**	**.2**	**1.0**	**.01**	**50**
CV(%)	**22.2**	**11.7**	**9.3**	**5.5**	**12.1**

CHICKPEA SEEDING RATE STUDY

Objectives: To evaluate the response of chickpea varieties to six seeding rates.

Procedures: Considering the high cost of chickpea seed, proper plant populations are important for optimizing yield and economic returns. A multi-year variety and seeding rate study was initiated at two locations (Wall and Hayes) in western South Dakota. Two chickpea varieties, Dwelly and Sierra were planted at six seeding rates on May 3, 2006 at Wall and Hayes. Seeding rates for each variety were 1 seed / sq. ft., 2 seeds / sq ft., 3 seeds / sq. ft., 4 seeds / sq.ft., 5 seeds / sq. ft. and 6 seeds / sq.ft. The trials were planted with a JD 750 no-till drill. The experimental design was a randomized complete block with treatments arranged in a factorial design. Treatments were replicated four times. Measurements taken include biomass at harvest, pod and seed production, grain yield, and harvest index. Harvest index is a measure of the ratio of grain weight to total plant weight. No nitrogen fertilizer was applied to the plots. Granular chickpea inoculant was placed with the seed into the furrow. Spartan was applied at both locations prior to planting to control weeds.

Results and Discussion: The effect of seeding rate and variety on plant height, number of pods per plant, number of seeds per plant, harvest index and grain yield at Wall and Hayes are presented in Tables 52 and 53. Yield increased with increase in seeding rate at Wall. The highest yield was recorded at 6 seeds per square foot although the yields from the top four seeding rates were not significantly different among each other. Number of pods/plant and number of seeds/plant were greater at lower seeding rates, indicating that plants compensated for lower seeding rates by producing more pods and more seeds. At the Hayes location, chickpea yields were low due to drought stress and the yield response to seeding rate was limited. A seed rate of 3 seeds per square foot had statistically the same yield as the 5 seeds per square foot. Yields were lowered when the seed rate was increase to 6 seeds per square foot.

Net returns based on cost of chickpea seed and value of the grain are shown on Tables 54 and 55. The best returns were at 1 seed per square foot rate although in most years this low seeding rate would invite increased weed pressure due to the lack of canopy cover. A seeding rate of 3 seeds per square foot is recommended for chickpeas in South Dakota. Increasing seeding rate beyond 3 seeds / square foot is cost prohibitive because of expensive seed prices and no statistical advantage in yield.

The variety Dwelly yielded greater than Sierra at both locations. The response to seeding rate was the same for both chickpea varieties.

Table 52. Harvest Index, Number of Pods/Plant, Number of Seeds/Plant, Number of Seeds/lb, Test Weight, and Yield of Chickpea at Wall In 2006.

	Harvest Index	Pods / Plant	Seeds / Plant	Seeds / Lb	Test Wt. (Lb/Bu)	Yield (Lb/A)
Seeding Rate (seeds/sq. ft)						
1	.37	22.8	27.7	1216	60.1	554
2	.35	15.3	15.9	1237	59.8	677
3	.34	14.1	14.8	1290	60.1	781
4	.32	10.7	11.1	1297	60.2	824
5	.32	9.8	10.9	1316	60.3	838
6	.27	8.1	8.4	1317	60.1	857
LSD (0.05)	**.08**	**6.1**	**8.4**	**54.3**	**n/a**	**87**
Variety						
Dwelly	.37	14.0	15.8	1328	60.5	903
Sierra	.29	12.9	13.8	1230	59.7	608
LSD (0.05)	**.05**	**3.5**	**4.8**	**31.3**	**n/a**	**122.9**
CV (%)	**25.7**	**44.9**	**56.2**	**4.1**	**n/a**	**11.2**

Table 53. Harvest Index, Pods/Plant, Seeds/Plant, Seeds / Lb, Test Wt. and Yield of Chickpea at Hayes in 2006.

	Harvest Index	Pods / Plant	Seeds / Plant	Seeds / Lb	Test Wt. (Lb/Bu)	Yield (Lb/A)
Seeding Rate (seeds/sq. ft.)						
1	.19	13.7	15.0	1396	58.7	308
2	.18	11.7	12.5	1415	59.7	374
3	.18	11.0	11.9	1407	59.0	459
4	.15	9.4	10.3	1516	59.1	417
5	.15	9.2	9.4	1428	58.8	440
6	.14	8.8	9.3	1593	59.6	384
LSD (0.05)	.03	3.8	4.3	133.9	n/a	48
Variety						
Dwelly	.17	11.8	12.4	1455	59.2	417
Sierra	.16	9.4	10.3	1463	59.2	377
LSD(0.05)	.02	2.2	2.5	77.3	n/a	64.8
CV(%)	22.0	35.7	37.3	9.0	n/a	11.3

Table 54. Seeding Rates Effect on Seed Size, Yield and Net Returns for the Chickpea Variety Dwelly at Wall in 2006.

Seeding Rate (seeds/sq. ft)	Seed < 18/64" (%)	Seed > 18/64" (%)	Seed > 20/64" (%)	Seed >22/64" (%)	Yield (lbs/A)	Value ($/A)	*Net Return($/A)
1	2	11	51	36	554	$97.27	$76.47
2	2	14	53	31	677	$113.11	$71.51
3	2	11	52	35	781	$136.27	$73.87
4	2	15	49	34	824	$139.58	$56.38
5	4	20	46	30	838	$131.56	$27.56
6	2	15	42	41	857	$151.76	$26.96

Seed Value <18/64"=no value, >18/64"=$.05/lb, >20/64"=$.15/lb, >22/64"= $0.26/lb.

*Net Return ($/A) = Value ($/A) minus seed cost / Acre.

Table 55. Seeding Rates Effect on Seed Size, Yield and Net Returns for the Chickpea Variety Dwelly at Hayes In 2006.

Seeding Rate (seeds/sq. ft)	< 18/64" (%)	> 18/64" (%)	> 20/64" (%)	>22/64" (%)	Yield (lbs/A)	Value ($/A)	*Net Return ($/A)
1	2	12	52	34	308	$53.08	$32.28
2	3	14	46	37	374	$64.38	$22.78
3	5	18	46	31	459	$72.79	$10.39
4	8	23	46	23	417	$58.49	$-24.71
5	4	20	63	13	440	$60.85	$-43.15
6	11	35	32	22	384	$47.11	$-77.69

Seed Value <18/64"= no value, >18/64"=$.05/lb, >20/64"=$.15/lb, >22/64"=$0.26/lb.

*Net Return ($/A) = Value ($/A) minus seed cost / Acre.

FIELD PEA PLANTING DATE STUDY – (2006)

Objective: To determine the effect of planting date on the yield of four field pea varieties

Procedures: Four varieties of field peas were planted at five planting dates at two locations in western South Dakota. The locations were Wall (Pennington County) and Hayes (Stanley County). The four pea varieties were Arvika, Grande, Carneval, and CDC Mozart. The first planting date was April 11, 2006 at Wall and April 12, 2006 at Hayes with the other four planting dates following at two week intervals. The experimental design was a randomized complete block with treatments arranged in a split-plot design. Planting date was the main plot and variety sub-plot. Treatments were replicated four times. The experiment was planted at 10-inch row spacing using the John Deere 750 drill. Spartan was applied at both locations by the cooperators prior to planting to control weeds. No N fertilizer was applied to the crop. Granular pea inoculant was placed with the seed in the furrow. Plots were harvested using a Wintersteiger small plot combine equipped with lifters and a pickup reel.

Results and Discussion: Planting was in good soil moisture at Wall resulting in good stand establishment. Conditions were again drier at Hayes resulting in poor plant stands. At Wall, plant height and yields were best when planting was done in mid April to early May. Yields dropped to about half when seeding was delayed until mid-May or later. Hayes was drier than Wall and yields were best for the April 12 planting date and dropped off significantly after that. The May 25 and June 5 planting dates at Hayes were not harvested because of poor stands. Planting field peas later than mid-May is not recommended in South Dakota. Field pea is very sensitive to high temperatures during flowering and when seeding is delayed beyond mid-May the crop will likely flower around mid-July increasing the risk of flower abortion due to heat stress. The variety CDC Mozart had the greatest yield at both locations.

Table 56. Plant Height, Test Weight and Yield of Field Pea at Wall, SD (Pennington County) In 2006.

Planting Date	Plant Height at Harvest (Inches)	Test weight (Lb/Bu)	Yield (Lb/Acre)
Planting Date			
April 11	23.4	59.1	1524
May 3	22.9	59.6	1530
May 15	22.3	--	732
May 25	20.2	--	348
June 5	17.3	--	168
LSD (0.05)	**1.4**	**0.5**	**54**
Variety			
Arvika	27.4	58.3	702
Grande	21.9	59.9	900
Carneval	19.4	58.8	900
CDC Mozart	16.2	60.4	936
LSD (0.05)	**1.2**	**0.4**	**48**
CV (%)	**9.1**	**1.9**	**9.4**

Table 57. Plant Height and Yield of Field Pea at Hayes, SD (Stanley County) In 2006.

Planting Date	Plant Height at Harvest (Inches)	Yield (Lb/Acre)
Planting Date		
April 12	15.2	721
May 3	16.3	440
May 15	16.6	113
May 25	--	--
June 5	--	--
LSD (0.05)	**1.0**	**36**
Variety		
Arvika	21.0	412
Grande	15.9	453
Carneval	14.7	412
CDC Mozart	12.5	421
LSD (0.05)	**0.9**	**36**
CV (%)	**10.6**	**16.1**

Table 58. Effect of Planting Date and Variety on Performance of Field Pea at Wall in 2006.

Planting Date	Variety	Height (inches) 7-24-06	Test Wt. (Lb/Bu)	Yield (Lb/A)
April 11	Arvika	30.3	59.3	1350
	Grande	25.3	58.9	1594
	Carneval	20.8	58.8	1490
	CDC Mozart	17.5	59.5	1664
Mean		**23.4**	**59.1**	**1524**
May 3	Arvika	31.3	57.4	1403
	Grande	23.5	61.0	1708
	Carneval	20.3	58.8	1516
	CDC Mozart	16.5	61.3	1498
Mean		**22.9**	**59.6**	**1531**
May 15	Arvika	29.5	--	514
	Grande	24.5	--	749
	Carneval	19.5	--	854
	CDC Mozart	15.8	--	802
Mean		**22.3**	--	**729**
May 25	Arvika	25.0	--	122
	Grande	19.8	--	331
	Carneval	19.8	--	444
	CDC Mozart	16.3	--	497
Mean		**20.2**	--	**348**
June 5	Arvika	21.0	--	131
	Grande	16.5	--	131
	Carneval	16.5	--	209
	CDC Mozart	15.0	--	209
Mean		**17.2**	--	**170**
	LSD (0.05)			
	Date	**1.4**	**0.5**	**57**
	Variety	**1.2**	**0.4**	**51**
	Date x Variety	**2.7**	**1.6**	**115**
	CV (%)	**9.1**	**1.9**	**9.4**

Table 59. Effect of Planting Date and Variety on Performance of Field Pea at Hayes in 2006.

Planting Date	Variety	Height (Inches) 7-11-06	Yield (Lb/A)
April 12	Arvika	21.3	758
	Grande	14.0	775
	Carneval	14.5	688
	CDC Mozart	11.0	662
Mean		**15.2**	**720**
May 3	Arvika	20.8	383
	Grande	17.3	488
	Carneval	14.3	427
	CDC Mozart	13.0	462
Mean		**16.3**	**440**
May 15	Arvika	21.0	96
	Grande	16.5	96
	Carneval	15.3	122
	CDC Mozart	13.5	139
Mean		**16.5**	**113**
May 25	Arvika	--	--
	Grande	--	--
	Carneval	--	--
	CDC Mozart	--	--
Mean		--	--
June 5	Arvika	--	--
	Grande	--	--
	Carneval	--	--
	CDC Mozart	--	--
Mean		--	--
	LSD (0.05)		
	Date	**1.0**	**36**
	Variety	**0.9**	**36**
	Date X Variety	**2.4**	**98**
	CV (%)	**10.6**	**16.1**

CHICKPEA PLANTING DATE STUDY (2005-2006)

Objective: To determine the effect of planting date on the yield of four chickpea varieties.

Procedures: Four varieties of chickpea were planted at five planting dates at two locations in western South Dakota. The locations were Wall (Pennington County) and Hayes (Stanley County). The four chickpea varieties were Dwelly, CDC Xena, Amit (B-90) and CDC Anna. The planting dates at Wall were on: April 11, May 3, May 15, May 25, and June 5. The planting dates at Hayes were on: April 12, May 3, May 15, May 25, and June 5. The May 25 and June 5 plantings at Wall were not harvested due to extremely dry conditions and poor yields. All five dates were harvested at Hayes in 2006. The experimental design was a randomized complete block with treatments arranged in a split-plot design. Planting date was the main plot and variety sub-plot. Treatments were replicated four times. The experiment was planted at 10-inch row spacing using the John Deere 750 drill. Spartan was applied at both locations by the cooperators prior to planting to control weeds. No N fertilizer was applied to the crop. Granular chickpea inoculant was placed with the seed in the furrow. Plots were harvested using a Wintersteiger small plot combine equipped with lifters and a pickup reel.

Results and Discussion: Results are presented on Tables 60 to 63. The Wall location had more moisture than the Hayes location hence stand establishment and plant growth were significantly better at Wall than at Hayes. Chickpea stands from later planted dates suffered from severe drought stress at both locations. The Wall location had problems with wild life grazing the crop. Yield decreased with delay in planting at both locations with the first planting date yielding significantly higher than all later planting dates. Yields were very low where planting was delayed to mid-May. These results confirm that chickpea should be planted before mid-May for good yields in South Dakota. We recommend that producers plant chickpea between mid-April and early-May. Earlier results from the chickpea planting date studies have shown that chickpea should be planted when soils have warmed up (to about 45°F) and the temperature on the rise. Planting early in April under our conditions in years with cool springs often results in delayed emergence and exposes the seed to infection by soilborne pathogens. CDC Xena performed well on the first two planting dates.

Table 60. Plant Height and Seed Yield of Chickpea at Wall (Pennington County) in 2006.

Treatments	Height (inches)	Yield (Lb/Acre)
Planting Date		
April 11	14.9	1106
May 3	16.2	865
May 15	16.1	78
May25	15.1	-
June 5	13.5	-
Mean	**15.1**	**683**
LSD (0.05)	**0.8**	**98**
Variety		
Dwelly	16.9	613
CDC Xena	14.3	831
Amit (B-90)	14.7	633
CDC Anna	14.8	656
Mean		
LSD(0.05)	**0.7**	**88**
CV (%)	**7.4**	**24.4**

Table 61. Plant Height and Seed Yield of Chickpeas at Hayes (Stanley County) in 2006.

Treatments	Height (Inches)	Yield (Lb/Acre)
Planting Date		
April 12	13.3	667
May 3	14.3	542
May 15	15.0	209
May25	13.9	89
June 5	12.4	30
Mean	**13.7**	**307**
LSD (0.05)	**0.7**	**57**
Variety		
Dwelly	15.6	251
CDC Xena	13.0	378
Amit (B-90)	13.6	247
CDC Anna	13.1	354
Mean	**13.7**	**307**
LSD(0.05)	**0.6**	**51**
CV(%)	**7.0**	**26.5**

Table 62. Effect of Planting Date and Chickpea Variety on performance of Chickpea at Wall in 2006.

Planting Date	Variety	Height (inches)	Yield (Lb/A)
April 11	Dwelly	16.8	1115
	CDC Xena	13.8	1246
	Amit (B-90)	14.8	1063
	CDC Anna	14.3	1002
Mean		**14.9**	**1106**
May 3	Dwelly	18.5	653
	CDC Xena	14.8	1159
	Amit (B-90)	15.8	784
	CDC Anna	15.8	862
Mean		**16.2**	**864**
May 15	Dwelly	17.8	70
	CDC Xena	15.0	87
	Amit (B-90)	15.5	52
	CDC Anna	16.0	105
Mean		**16.0**	**78.5**
May 25	Dwelly	16.5	--
	CDC Xena	14.5	--
	Amit (B-90)	14.8	--
	CDC Anna	14.8	--
Mean		**15.1**	--
June 5	Dwelly	14.8	--
	CDC Xena	13.5	--
	Amit (B-90)	12.5	--
	CDC Anna	13.3	--
Mean		**13.5**	--
	LSD (0.05)		
	Date	**0.8**	**98**
	Variety	**0.7**	**88**
	Date X Variety	**1.6**	**197**
	CV (%)	**7.4**	**24.4**

Table 63. Effect of Planting Date and Variety on Performance of Chickpea at Hayes In 2006.

Planting Date	Variety	Height (Inches)	Yield (Lb/A)
April 12	Dwelly	15.3	576
	CDC Xena	12.3	767
	Amit (B-90)	13.5	619
	CDC Anna	12.3	706
Mean		**13.3**	**667**
May 3	Dwelly	16.5	392
	CDC Xena	13.0	732
	Amit (B-90)	15.5	444
	CDC Anna	12.0	601
Mean		**14.2**	**542**
May 15	Dwelly	17.3	192
	CDC Xena	14.0	279
	Amit (B-90)	13.8	113
	CDC Anna	15.0	253
Mean		**15.0**	**209**
May 25	Dwelly	15.0	52
	CDC Xena	13.5	78
	Amit (B-90)	13.5	44
	CDC Anna	13.8	183
Mean		**13.9**	**89**
June 5	Dwelly	13.8	44
	CDC Xena	12.3	35
	Amit (B-90)	11.5	17
	CDC Anna	12.3	26
Mean		**12.4**	**30**
	LSD (0.05)		
	Date	**0.7**	**57**
	Variety	**0.6**	**51**
	Date X Variety	**1.4**	**114**
	CV (%)	**7.0**	**26.5**

WINTER WHEAT PLANTING DATE STUDY

Objectives: To determine the responses of winter wheat varieties to different planting dates.

Procedures: Eight winter wheat varieties were planted at five planting dates at two locations in the fall of 2005. The locations were at Wall and Scenic in western South Dakota. The Wall location was planted into millet stubble with a John Deere 750 disk drill. The Scenic location was planted into black fallow with a John Deere 750 disk drill. The experimental design was a randomized complete block with treatments arranged in a split-plot design. Planting date was the main plot and variety subplot. Treatments were replicated four times. Starter fertilizer was applied at six gallons per acre (10-34-0) at seeding time at both locations. The Wall location was top dressed with 80 pounds of nitrogen per acre (26.6 gal 28-0-0) on April 6, 2006. The Wall location was weed free so it was not sprayed. The Scenic location was top dressed with 80 pounds of nitrogen per acre (26.6 gal 28-0-0) on April 13, 2006. The Scenic location was sprayed with 16 oz/A Starane + .3 oz / A Harmony GT on April 11, 2006. Both locations were harvested on July 18, 2006. The trials were harvested with a Wintersteiger Delta research combine. Measurements taken at harvest included plant height, number of heads / square foot, number of kernels per head, number of seeds per pound, grain protein, test weight and grain yield.

Results and Discussion: Results are presented on Tables 64 to 69. At Wall, stand establishment for all planting dates was good. Stands at Scenic were less than ideal on the first planting date because the soil was very dry at planting time. This probably had a direct correlation with lower yields recorded for the September 15 planting date. The following four planting dates had good stands but the Scenic location continued to be short of moisture throughout most of the growing season.

At Wall, the highest yield was from the October 15 planting date. Winter wheat yield from this planting date was significantly higher than the yield from the earlier as well as later planting dates. Earlier planting dates (Sept 15 and Oct. 1) were adversely affected by drought reducing stand establishment and number of heads per square foot. Yields were reduced by delaying planting beyond October 15 with the December 1 planting date recording the lowest yield. The reduction in yield was mostly due to the reduction in number of heads per square foot. While winter wheat planted in December had a greater number of kernels per head, this increase was not enough to offset the reduction in tillering due to late planting.

At Scenic, soil moisture was the most limiting factor affecting yield and the response to planting date. The first two dates were planted under very dry conditions hence the yields were very low. The best yields were obtained from the October 15 planting date with yields decreasing as planting was delayed beyond October 15. Similar to what was observed at the Wall location, later planting dates had less number of heads per square foot likely due to fewer tillers. The December planting date had significantly higher grain protein than earlier planting dates at both locations but yields were the lowest at this date.

The eight winter wheat varieties responded similarly to planting date, meaning that yields were reduced by delay in planting irrespective of variety. The best performing varieties in terms of grain were Wendy and Wesley. At Wall; plant height, number of kernels per head, number of seeds/lb and test weight were not consistent among varieties over planting dates. At Scenic, only test weight was not consistent among varieties over planting dates. Overley was consistently large seeded at all five planting dates and both locations. Jagalene had consistent high test weight over all five planting dates at both locations. Overley had consistently high grain protein on all five planting dates at both locations. Russ spring wheat was planted on December 1 at both locations to compare to dormant planted winter wheat. Yields of spring wheat were lower than winter wheat planted on the same date.

Table 64. Mean Effect of Planting Date on Performance of Winter Wheat (Wall - 2006).

Planting Date	Height (Inches)	# of Heads/sq ft.	# of Kernels / Head	# of Seeds / pound	Protein (%)	Test Wt (Lb/bu)	Yield (Bu/A)
September 15	24.5	37.1	25.7	16397	13.0	61.7	40.8
October 1	24.9	41.1	25.8	17158	12.9	60.7	40.2
October 15	24.9	44.0	24.7	16776	13.4	63.4	43.9
November 1	24.9	44.3	27.1	15727	13.6	62.6	41.9
December 1	24.6	38.9	29.5	16284	13.7	63.6	37.4
LSD (0.05)	**0.4**	**3.2**	**1.3**	**459.9**	**0.2**	**0.5**	**1.9**
CV (%)	**3.4**	**15.6**	**9.5**	**5.6**	**3.7**	**1.7**	**9.5**

Table 65. Mean Effect of Variety on Performance of Winter Wheat (Wall - 2006).

Varieties	Height (inches)	# of Heads/sq ft.	# of Kernels / Head	# of Seeds / Lb	Protein (%)	Test Wt. (Lb/bu)	Yield (Bu/A)
Overley	24.6	32.3	28.7	14121	13.7	63.1	39.5
Jagalene	24.6	36.8	29.1	15488	13.1	64.4	41.9
Wesley	24.1	43.2	26.2	16155	13.4	61.3	41.4
Expedition	24.6	40.2	24.1	15334	13.4	62.2	39.6
Arapahoe	27.6	37.1	28.1	17320	13.5	62.7	40.6
Harding	28.3	41.5	28.1	18340	13.5	62.1	40.1
Trego	22.5	49.5	23.0	16371	13.1	60.4	40.8
Wendy	21.8	48.0	25.3	18620	12.9	62.9	42.9
LSD(0.05)	**0.5**	**4.0**	**1.6**	**581.7**	**0.3**	**0.7**	**2.4**
CV (%)	**3.4**	**15.6**	**9.5**	**5.6**	**3.7**	**1.7**	**9.5**

Table 66. Mean Effect of Planting Date on Performance of Winter Wheat (Scenic - 2006).

Planting Date	Height (inches)	# of Heads/sq ft.	# of Kernels / Head	# of Seeds / pound	Protein (%)	Test Wt. (Lb/bu)	Yield (Bu/A)
September 15	20.9	36.9	26.7	16476	13.1	60.8	27.1
October 1	20.8	35.5	27.1	16389	12.8	61.6	31.2
October 15	21.4	32.9	25.1	15627	12.8	62.6	35.2
November 1	20.7	35.4	29.2	15369	13.1	61.2	30.1
December 1	19.8	29.0	27.1	16134	13.9	59.2	21.1
LSD (0.05)	**0.7**	**3.7**	**1.5**	**732.4**	**0.2**	**1.2**	**1.7**
CV(%)	**6.3**	**22.0**	**11.1**	**9.2**	**3.2**	**5.4**	**12.0**

Table 67. Mean Effect of Variety on Performance of Winter Wheat (Scenic - 2006).

Varieties	Height (inches)	# of Heads/sq ft.	# of Kernels / Head	# of Seeds / pound	Protein (%)	Test Wt. (Lb/bu)	Yield (Bu/A)
Overley	19.8	24.2	28.4	14304	14.0	61.5	24.0
Jagalene	20.3	28.7	31.9	14814	13.3	64.1	26.4
Wesley	19.8	32.5	25.3	15837	13.3	61.4	31.1
Expedition	20.2	34.5	23.5	14825	13.0	61.1	28.1
Arapahoe	23.7	38.4	27.9	16766	13.2	60.9	31.4
Harding	23.8	33.9	28.7	18630	13.1	59.7	30.8
Trego	19.3	37.9	24.0	15171	12.4	57.7	28.4
Wendy	18.7	41.4	26.6	17643	12.8	62.1	31.4
LSD(0.05)	**0.8**	**4.7**	**1.9**	**926.5**	**0.3**	**1.5**	**2.2**
CV(%)	**6.3**	**22.0**	**11.1**	**9.2**	**3.2**	**4.2**	**12.0**

Table 68. Effect of Planting Date and Variety on Performance of Winter Wheat at Wall in 2006.

Planting Date	Variety	Height (inches)	# of Heads/ Sq. Ft.	# of Kernels / Head	# of Seeds / Lb	Protein (%)	Test Wt. (Lb/Bu)	Yield (Bu/A)
Sept. 15	Overley	24.4	32.0	29.8	13872	13.2	62.9	40.6
	Jagalene	24.7	31.5	27.3	15218	12.8	65.3	41.5
	Wesley	23.6	39.3	25.9	15978	12.9	60.4	41.8
	Expedition	23.8	38.3	23.0	15310	13.0	61.6	39.6
	Arapahoe	28.1	35.5	25.8	17417	13.3	62.0	39.9
	Harding	28.2	33.8	30.6	18959	13.5	61.5	38.5
	Trego	21.9	44.0	19.3	15687	12.6	58.8	41.5
	Wendy	21.4	42.3	24.2	18733	12.8	61.2	43.2
Mean		**24.5**	**37.1**	**25.7**	**16397**	**13.0**	**61.7**	**40.8**
Oct. 1	Overley	24.7	32.3	28.7	15328	13.2	61.8	37.1
	Jagalene	24.7	37.3	27.6	16714	12.6	63.2	41.4
	Wesley	24.1	40.8	25.9	17408	13.2	58.4	41.8
	Expedition	24.1	38.0	23.8	16401	13.0	60.1	40.0
	Arapahoe	27.6	39.5	27.6	17870	13.6	60.8	36.8
	Harding	29.8	43.5	25.9	18309	12.8	61.9	42.4
	Trego	21.8	52.3	21.6	16211	12.8	58.2	40.2
	Wendy	22.0	45.3	25.8	19025	12.3	61.1	42.1
Mean		**24.9**	**41.1**	**25.8**	**17158**	**12.9**	**60.7**	**40.2**
Oct. 15	Overley	24.8	31.3	26.9	14285	13.5	63.7	41.4
	Jagalene	24.6	36.0	27.5	16183	13.1	64.9	43.0
	Wesley	24.5	45.5	26.0	16651	13.5	62.4	44.3
	Expedition	24.5	47.8	23.2	15527	13.6	63.8	44.1
	Arapahoe	28.1	37.3	26.0	16869	13.3	63.6	45.3
	Harding	29.4	47.0	25.0	19340	13.5	63.9	43.9
	Trego	22.1	55.5	20.6	16591	13.5	60.8	44.1
	Wendy	21.1	51.8	22.9	18760	13.0	64.1	45.0
Mean		**24.9**	**44.0**	**24.7**	**16776**	**13.4**	**63.4**	**43.9**
Nov. 1	Overley	24.8	35.3	28.4	13313	14.0	63.7	43.6
	Jagalene	24.5	41.8	29.9	14873	13.4	64.2	44.3
	Wesley	24.2	49.0	24.1	15508	14.0	62.1	40.0
	Expedition	25.1	42.8	24.7	14458	13.6	62.8	39.4
	Arapahoe	27.6	37.3	31.3	16498	13.8	62.9	39.2
	Harding	28.3	46.0	30.7	17546	13.7	61.2	40.9
	Trego	23.3	49.0	23.9	15591	13.2	60.7	41.7
	Wendy	21.9	53.5	24.0	16031	13.3	63.0	45.8
Mean		**24.9**	**44.3**	**27.1**	**15727**	**13.6**	**62.6**	**41.9**
Dec. 1	Overley	24.4	30.5	29.8	13805	14.4	63.5	34.9
	Jagalene	24.5	37.5	33.4	14453	13.5	64.2	39.6
	Wesley	24.1	41.5	29.2	15231	13.6	63.1	38.9
	Expedition	25.5	34.3	26.1	14973	13.7	62.6	35.2
	Arapahoe	26.5	36.0	29.7	17943	13.7	64.3	41.5
	Harding	26.0	37.3	28.4	17543	14.1	62.0	34.6
	Trego	23.3	46.8	29.9	17774	13.6	63.5	36.7
	Wendy	22.8	47.3	29.7	18551	13.2	65.2	38.2
Mean		**24.6**	**38.9**	**29.5**	**16284**	**13.7**	**63.6**	**37.4**
Dec. 1	*Russ-HRS	--	--	--	--	15.6	62.1	32.9
	Date X Variety							
	LSD =.05	**1.2**	**ns**	**3.5**	**1300.8**	**ns**	**1.5**	**ns**
	CV=	**3.4**	**15.6**	**9.5**	**5.6**	**3.7**	**1.7**	**9.5**

Note: *Russ-HRS is not statistically analyzed with the winter wheat varieties

Table 69. Effect of Planting Date and Variety on Performance of Winter Wheat at Scenic in 2006.

Planting Date	Variety	Height (inches)	# of Heads / Sq. Ft.	# of Kernels / Head	# of Seeds / Lb	Protein (%)	Test Wt. (Lb/Bu)	Yield (Bu/A)
Sept. 15	Overley	19.7	23.8	27.3	14195	13.6	62.4	21.3
	Jagalene	20.5	33.3	30.6	14732	13.2	63.8	24.8
	Wesley	20.2	35.3	23.8	15836	13.2	60.3	28.1
	Expedition	20.5	32.0	24.3	14674	12.9	59.6	27.3
	Arapahoe	24.0	44.5	28.7	17389	13.1	59.9	30.1
	Harding	24.3	40.3	28.9	19880	13.4	57.8	28.9
	Trego	18.3	42.0	22.1	15757	12.5	60.4	26.6
	Wendy	19.5	44.0	28.1	19344	13.0	62.0	30.2
Mean		**20.9**	**36.9**	**26.7**	**16476**	**13.1**	**60.8**	**27.1**
Oct. 1	Overley	20.5	27.5	29.7	14690	13.5	61.0	24.5
	Jagalene	19.2	26.5	31.7	15612	13.6	65.3	24.9
	Wesley	19.7	34.0	25.0	16442	13.0	61.2	34.2
	Expedition	19.7	39.0	23.1	15565	12.5	60.4	31.3
	Arapahoe	24.3	36.3	27.8	17168	13.0	61.1	32.3
	Harding	24.6	32.0	30.3	18505	12.6	61.6	34.9
	Trego	19.4	41.3	22.1	14916	12.0	59.6	32.8
	Wendy	19.5	47.3	27.0	18218	12.1	62.7	34.6
Mean		**20.8**	**35.5**	**27.1**	**16389**	**12.8**	**61.6**	**31.2**
Oct. 15	Overley	20.7	23.8	25.6	13672	13.8	61.7	28.9
	Jagalene	21.4	29.3	28.5	14215	13.0	64.2	33.4
	Wesley	20.7	31.3	25.5	14314	12.8	62.5	37.4
	Expedition	20.2	36.0	21.0	14772	12.8	63.6	33.4
	Arapahoe	24.7	36.5	27.2	16762	12.9	62.4	37.7
	Harding	25.0	31.8	28.0	18648	12.6	61.3	37.5
	Trego	19.8	41.5	20.8	15686	12.1	60.8	37.7
	Wendy	18.6	33.0	24.3	16945	12.6	64.3	35.5
Mean		**21.4**	**32.9**	**25.1**	**15627**	**12.8**	**62.6**	**35.2**
Nov. 1	Overley	19.3	25.5	31.0	14354	14.4	61.8	26.0
	Jagalene	20.6	28.8	34.3	14200	13.0	63.8	27.9
	Wesley	19.4	31.8	27.0	14805	13.3	62.4	31.9
	Expedition	21.0	34.5	25.3	14211	13.0	62.2	29.0
	Arapahoe	23.6	43.0	30.9	16109	13.1	60.9	32.5
	Harding	23.2	37.0	29.5	17434	13.0	59.2	32.0
	Trego	20.6	35.5	27.9	14525	12.3	58.1	29.5
	Wendy	18.4	47.0	27.7	17311	12.8	61.2	32.0
Mean		**20.7**	**35.4**	**29.2**	**15369**	**13.1**	**61.2**	**30.1**
Dec. 1	Overley	18.7	20.5	28.3	14607	15.1	60.8	19.3
	Jagalene	20.0	25.5	34.6	15309	13.8	63.7	20.8
	Wesley	19.3	30.0	25.0	17787	14.3	60.5	24.0
	Expedition	19.5	31.0	23.8	14905	13.8	59.9	19.6
	Arapahoe	22.1	31.8	25.2	16414	14.0	60.3	24.5
	Harding	22.0	28.3	26.7	18681	13.8	58.7	20.7
	Trego	18.7	29.3	27.0	14969	13.4	49.5	15.3
	Wendy	17.9	35.5	28.1	16400	13.6	60.4	24.8
Mean		**19.8**	**29.0**	**27.1**	**16134**	**13.9**	**59.2**	**21.1**
Dec. 1	*Russ-HRS	–	–	–	–	15.6	59.1	12.6
	Date X Variety							
	LSD (.05)	**ns**	**ns**	**ns**	**ns**	**ns**	**3.5**	**ns**
	CV=	**6.3**	**22.0**	**11.1**	**9.2**	**3.2**	**5.4**	**12.0**

Note: *Russ-HRS is not statistically analyzed with the winter wheat varieties.

SDSU REDUCED TILLAGE AND NO-TILL CROP ROTATION STUDY
WALL, SOUTH DAKOTA

OBJECTIVES

1. To determine crop productivity in varied rotations with different crop intensities.
2. To determine economic returns from various rotation systems with varied levels of crop intensification and diversity.

PROCEDURES

The study with nine different rotations was established in the spring of 1994. The rotations are two to six years in duration and we have completed at least one full cycle in all of the rotation sequences. All phases in each rotation are grown each year. No-till production practices are used to grow all crops except for the winter wheat conventional fallow treatment. Millet, peas, spring barley and winter wheat were planted with a JD 750 no-till drill at 10 inch row spacing. The fallow winter wheat is planted with a JD 610 drill at 10 inch row spacing. The safflower, corn and sunflower are planted with a JD 7100 corn planter in 20 inch rows. Nitrogen and phosphorus fertilizer are injected in the fall using strip tillage preparing the zone for planting by the JD 7100 corn planter the following summer.

The experimental design is a randomized complete block with treatments replicated four times. Plots are 80' x 25' in size, the small size allows all the plots to be located on the same soil type and reduces variability due to soil characteristics. The crop yields were measured from each plot and analyzed to compute the average yields for each rotation. Detailed records of all the cultural practices including spraying for insect pests, diseases, and weed control are kept and cost of each practice assessed, and are given on Appendix 1. This allows for yield and economic comparisons to be made each year.

RESULTS AND DISCUSSION

Long term trends

Long term results have shown that the inclusion of broadleaf crops such as sunflower, safflower and peas; along with warm season grass crops like corn helps to break weed and disease cycles and improves wheat yields and profitability. It should be noted that we do not include any farm program payments, except loan deficiency payments (LDP), in our economic analysis.

The eight year (1999-2006) average yield of winter wheat following millet in a rotation where a broadleaf crop or corn was grown prior to the millet was 40.3 Bu/A. The winter wheat grown in a continuous winter wheat-millet rotation had an average yield of 35.9 Bu/A. This indicates a 4.4 bushels per acre difference due to introducing a broadleaf or wann season crop into the rotation as the same management practices were applied in both rotations over the eight year period. These results indicate the importance of crop diversity in a rotation system. For comparison, the winter wheat-fallow rotation had an average yield of 47.7 Bu/A while fallow wheat in the diversified rotation of 2a yielded 55.3 bushels per acre over the 8 year period.

Introducing safflower, sunflower and pea crops in the winter wheat-millet rotation would be expected to increase demand for soil moisture and thus decrease winter wheat yield compared to the winter wheat-millet rotation. The winter wheat in rotations with safflower, sunflower and pea, however, yielded more than the winter wheat-millet rotation, indicating the increasing problem with root diseases in the undiversified winter wheat-millet rotation (Table 72). The increased income from the higher yields of winter wheat along with the opportunity

to produce a profitable broadleaf crop like sunflower or safflower increased the net income of these rotations. It should be noted that the drought of 2002 had a large impact on profitability and that when 2002 data are left out of the averages, the more diverse rotations do have more consistent profitability. Long term yields and economics are presented with and without the 2002 year for comparisons.

We continue to refine the strip tillage system that we use for corn, sunflowers and safflower. The fertilizer is injected in the fall using a narrow point opener which leaves about a four inch area strip tilled. We have added some reverse mounted closing disks to fill the trench formed by the injector, but still having minimal soil disturbance. In the spring; corn, safflower and sunflowers are planted over the same strips. Since going to this system, plant stands of corn and sunflowers have improved. The residue managers on our planter work better in the strip tilled wheat stubble and it has the added bonus of putting the fertilizer right were the plants will utilize it. We have lowered plant populations for corn and sunflowers. The last few dry years have shown us that our plant populations were probably unrealistically high.

Recent cropping changes in this study include: 1) in Rotation 5a, changing the spring wheat to feed barley, 2) in Rotation 6a growing dry peas to grain rather than spraying them off as a green manure crop, and in 9a, using hairy vetch as a green fallow option rather than using forage peas, 3) in 2007; Rotation 10 will be changed to winter wheat / millet / chickpea. Our six-year rotation has shown us that longer diverse rotations are better than the mostly three-year rotations we started with. We plan to introduce some flex-cropping options with moisture conditions helping us to decide which crop to plant or whether to fallow.

Table 73 shows the estimated yield goals used for fertilizer recommendations for each crop and rotation since 1999. Thus, all crops have been adequately fertilized with nitrogen since the beginning of the study in 1994. However, our long term results show that attained yields for most crops are below yield goals (Table 72). For economic reasons, we have decided to lower yield goals to match long-term average yields for each crop and rotation starting in 2006.

2006 Yield Results

Rotation 1: Winter Wheat / Fallow

This is the base rotation that all other rotations in the study are compared to. Jagalene winter wheat was planted on September 20, 2005 with a JD 610 drill. Liquid starter fertilizer was applied at planting time at six gallons of 10-34-0 per acre. Winter wheat stands were less than ideal in the fall of 2005 due to dry soil conditions. Spring rainfall of 1.36 inches in April and 1.21 inches in May were minimal too as the drought continues. Yields during this growing season were at 31 bu/a. Yields in 2006 were lower than the long-term 8 year average of 47.7 Bu/A.

Rotation 2: Winter Wheat-a / Sunflower / Millet / Winter Wheat-b / Corn / Fallow

This is a very diverse rotation that provides many opportunities for weed control and disease suppression. On the long term, yields from this rotation have been above average even in the dry years. The best winter wheat yields from this rotation have been from winter wheat following fallow (Winter wheat –a) that has consistently out-yielded the fallow wheat in Rotation 1 by about 7 1/2 Bu/Acre over the last eight years. On the other hand, winter wheat following millet on average yielded about 72% the yield of the fallow wheat. Sunflower yields have averaged 1342 Lb/Acre (Table 72) with extremely low yields in 2002 and 2003 due to drought stress. Millet yields in this rotation have averaged 909 Lb/Acre over the last 8 years. Millet yields are lower in this rotation than any in the trial. Sunflower is deep rooted and tends to dry out the soil profile considerably, thus millet grown after the sunflower crop is very dependant upon spring rains to recharge the top two feet of soil. This rotation requires nitrogen applications on every crop so there are no fertilizer savings as is observed in rotations with legumes. The diversity of warm and cool season crops in this six- year rotation spreads the work-load out for the producer. This rotation requires more equipment than most other rotations.

Rotation 3: Winter Wheat / Safflower / Millet

Winter wheat in this rotation yielded 40.3 Bu/A in 2006 and has averaged 39 Bu/A long term. Safflower yields were 489 Lb/A in 2006 and averaged 880 Lb/A in a eight-year period (Table 72). Millet yields were 400 Lb/A in 2006 with a eight-year average of 1090 Lb/A. The safflower crop is deep-rooted and dries out the ground for the upcoming millet crop. During dry seasons, a summer fallow treatment could be used to replace the millet crop. Yields of millet have been variable in this rotation depending upon amount of snow catch in the safflower stubble and the amount of rainfall before and during the millet crop.

This rotation provides the diversity of a broadleaf crop along with cool season and warm season grass crops. The two warm season crops are relatively drought tolerant and the winter wheat makes most of its growth during the cool portion of the summer. This rotation will make full use of all precipitation received. The rotation can be planted with small grain equipment and therefore does not require any additional investment in equipment.

Rotation 4: Winter Wheat / Millet

This rotation alternates between winter wheat and Proso (grain) millet. The millet crop is a good replacement for summer fallow. Winter wheat yields in this rotation have averaged 35.9 Bu/A over a eight-year period. Millet yields, on the other hand, have averaged 1511 Lb/A over the last eight years. In 2006, the winter wheat yields (37.8 Bu/A) were close to the eight-year average while the millet yields (1000 Lb/A) were below average. This rotation is not well diversified and will harbor crown and root rots over time. In some years, large amounts of residue on the soil surface after the winter wheat crop has caused some difficulty in establishing a good stand of millet. On average, winter wheat in this rotation has yielded 75 percent of the fallow winter wheat yields from Rotation 1. This is a rather narrow rotation that does not provide adequate diversity of crops for good weed control.

Table 70. Hard Red Winter Wheat Yields from Different Rotations at Wall in 2006 and Long Term (1999-2006).

Rotation	Crop Sequence	Protein 2006 (%)	Test Wt 2006 (Lb/Bu)	Yield 2006 (Bu/A)	Protein w/o 2002 1999-06 (%)	Ave Yield w/o 2002 1999-06 (Bu/A)
1	**WW** / F	14.7	63.9	31.0	13.2	50.5
2a	WW / C / F/ **WW** / Su / M	14.3	64.7	49.8	13.2	58.8
2a	**WW** / C / F/ WW / Su / M	13.0	63.1	38.1	11.9	44.3
3	**WW** / Sa / M	12.1	64.2	40.3	11.7	43.3
4	**WW** / M	10.8	64.3	37.8	12.0	36.0
5a	**WW** / C / Su / S Bar	13.5	62.1	37.0	12.1	38.8
6a	**WW** / WW / Sa / FP	15.0	63.4	25.5	13.8	46.2
6a	WW / **WW** / Sa / FP	13.1	62.1	26.5	12.5	36.3
9a	**WW** / WW / Sa / HV	14.9	63.1	34.4	13.4	45.3
9a	WW / **WW** / Sa / HV	12.5	62.1	35.2	12.7	37.3
10	**WW** / CP / M	10.9	65.4	33.5	11.5	40.6
11	**WW** / C / M	12.0	64.6	41.7	11.6	45.2
LSD(.05)			1.7	7.6	n/a	n/a
CV (%)			1.8	14.8	n/a	n/a

The long term value does not include 2002 wheat yield. WW = winter wheat, F=fallow, C=corn, Su=sunflower, M=millet, Sa=safflower, FP=field peas, HV=hairy vetch, CP=chickpea, S Bar=spring barley

Table 71. Net Returns from 2006 Crop at The Wall Rotation

	Rotations and Crop Yields:	Dollars Return / A.
1	Winter Wheat 31.0 bu / Fallow	$ - 18.81
2a	Winter Wheat-A 49.8 bu / Sunflower 1030 lbs / Millet 300lbs / Winter Wheat-B 38.1 bu / Corn 0 bu / Fallow	$ - 27.32
3	Winter Wheat 40.3 bu / Safflower 489lbs / Millet 400 lbs	$ - 27.38
4	Winter Wheat 37.8 bu / Millet 1000 lbs	$ 4.53
5a	Winter Wheat 37.0 bu / Corn 0 bu / Sunflower 500 lbs (estimated) / Spring Barley 15.8 bu	$ - 62.64
6a	Winter Wheat-B 26.5 bu / Safflower 548lbs / Dry Pea 1308 lbs / Winter Wheat-A 25.5 bu	$ - 14.15
9a	Winter Wheal-B 35.2 bu / Safflower 516 lbs / Hairy Vetch / Winter Wheat-A 34.4 bu	$ - 22.75
10	Winter Wheat 33.5 bu / Chickpeas 800lbs / Millet 900lbs	$ - 11.83
11	Winter Wheat 41.7 bu / Corn 0 bu / Millet 600 lbs	$ - 49.72

estimated = Sunflowers were destroyed by deer when heads were 2" in diameter.

Rotation 5a: Winter Wheat / Corn / Sunflower / Spring Barley:

This is a very intensive rotation with high moisture demand. That coupled with drought in the past few years has again spelled economic disaster. Winter wheat yields have averaged 34.4 Bu/A over the eight-year period. Corn yields averaged 44.6 Bu/A over the last eight years though corn failed completely in 2002, 2003, and 2006 due to drought/heat stress. Sunflower yields from this rotation have been the lowest yielding in the study over the eight-year period (1999-2006). Spring wheat has not performed well after sunflower and even more so in drier years. Sunflower is harvested late in the fall, and leaves limited stubble to catch snow. Spring barley replaced spring wheat in 2005. Barley is more drought tolerant than spring wheat and matures before spring wheat. Barley yields in 2006 were poor (15.8 Bu/A) due to lack of rain during the spring months.

Rotation 6a: Winter Wheat-a / Winter Wheat-b/ Safflower / Field Pea:

This rotation was changed in 2005. The original rotation had pea grown as a green fallow crop. The pea green fallow in this rotation was designed to lower the demand for fertilizer nitrogen in the rotation. The peas were grown only until early bloom and then killed by a herbicide spray. By bloom, peas have accumulated a good amount of biomass to benefit the following crop and at the same time killing the crop at this stage allowed for potential soil moisture recharge before the winter wheat crop. The winter wheat grown after the pea-fallow seem to have benefited averaging 41.8 Bu/A over a eight-year period compared to the 32.5 Bu/A eight-year average for the second winter wheat in the rotation. Sunflower, formerly in the rotation was switched to safflower in 2005 to allow for better comparison to Rotation 9a. Safflower and sunflower yields are very comparable in dry years but the sunflower will out yield safflower in wetter years. Peas have proven too expensive to grow as a green fallow crop, thus in 2005 the rotation was changed and the peas have been grown for grain rather than as a green fallow crop. The field peas have an average yield of 1356 Lb/A over the last two years. Planting dry peas eliminates the need to add nitrogen fertilizer during that year.

Rotation 9: Winter Wheat-a / Winter Wheat-b / Safflower / Hairy Vetch:

The winter wheat grown after the legume-fallow has averaged 40.9 Bu/A over a eight-year period. The second winter wheat crop has averaged 33.3 Bu/A in the same eight-year period (1999-2006). Safflower in this rotation has the highest safflower yield in the study with a seven-year average of 975 Lb/A. This rotation saw changes in 2005 with addition of Hairy Vetch to replace pea green fallow. Hairy vetch produces more biomass, is more vegetative and the stubble tends to cling to the ground better than the pea stubble. The better ground cover of the hairy vetch should provide better snow catch which will benefit the following winter wheat crop. Like in rotation 6a, the legume fallow segment of the rotation has not been cost effective. We planted the hairy vetch into the safflower stalks on September 28, 2006. We are evaluating the hairy vetch for winter hardiness and hopefully this will allow the crop to initiate growth sooner in the spring.

Rotation 10: Winter Wheat / Chickpea / Millet:

This is a well diversified rotation and historically, this rotation has produced some of the best recrop winter wheat yields in the entire study. On the long term, winter wheat in this rotation has averaged 40.9 Bu/A over the last eight years (1999-2006). The six-year average (2001-2006) yield for the chickpea crop is 735 Lb/A. This includes the 2002 drought year that yielded 95 Lb/A. Millet yields after the pea crop have been consistently good with a six-year average of 1333 Lb/A.

This is a high risk and potentially high rate of return rotation depending on how the chickpea crop performs. Chickpea is an expensive crop to grow due to the high cost of seed. However, if the crop yields well, the returns are extremely good. It should be noted that three years between chickpea crops is too close because of ascochyta concerns, the recommendation is at least four years. This rotation will be changed to winter wheat / millet / chickpea in 2007. This is being to done to compare pulse crops planted before winter wheat. Chickpeas in rotation 10 to field peas and hairy vetch in rotations 6a and 9a.

Rotation 11: Winter Wheat / Corn / Millet:

This is an intensive continuous crop rotation. Inclusion of glyphosate tolerant corn in the rotation allows us to manage weeds much better. The injection of fertilizer in the fall allows us to plant corn into a tilled strip that is 2 to 4 degrees warmer than the non-tilled area between the rows. The winter wheat has averaged 41.2 Bu/A over the last eight years (1999-2006) and yielded 41.7 Bu/A in 2006 (Table 72). Corn plant populations were reduced to 14,200 seeds/acre in 2004 and 2005 to reduce seed costs and plant competition for soil moisture. In 2006, corn population was reduced again. This time, corn populations were reduced to 12,500 seeds/acre. The eight-year average yield for corn is 58.3 Bu/A and this includes 2002 and 2006 that were total crop failures. It is worthy to note that in 2003 corn in this rotation yielded 39.7 Bu/A while corn in rotations 2a and 5a totally failed. Corn in Rotation 11 has the highest corn long-term yields in the study. Proso millet yields have averaged 1108 Lb/A over the last eight years (1999-06).

Table 72. Long-Term Yield Trends at The Wall Rotation Study (1999-2006).

Rotation & Crop	1999	2000	2001	2002	2003	2004	2005	2006	Ave Yield (Bu/A) (lb/A) (1999-06) (w / 2002)	Ave Yield (Bu/A) (lb/A) (1999-06) (w/o 2002)
Rotation 1										
Winter Wheat	70.9	58.3	38.6	28.6	77.1	17.7	60.0	31.0	47.7	50.5 bu
Fallow	0	0	0	0	0	0	0	0	0	0
Rotation 2a										
Winter Wheat-a	67.1	66.9	51.1	30.9	72.8	34.3	70.0	49.8	55.3	58.8 bu
Sunflower	2091	2602	2082	400	584	1093	860	1030	1342	1477 lb
Millet	1500	1300	2000	326	0	449	1405	300	909	993 lb
Winter Wheat-b	62.8	46.0	40.2	10.7	46.3	27.1	50.0	38.1	40.1	44.3bu
Corn	107.6	65.8	97.5	0	0	70.3	55.0	0	49.5	56.6 bu
Fallow	0	0	0	0	0	0	0	0	0	0
Rotation 3										
Winter Wheat	57.2	45.4	38.1	9.8	47.8	24.2	50.0	40.3	39.1	43.3 bu
Safflower	976	1391	1575	360	614	957	685	489	880	955 lb
Millet	1500	1266	2000	783	0	867	1906	400	1090	1134 lb
Rotation 4										
Winter Wheat	47.2	32.6	33.7	14.7	57.4	28.9	35.0	37.8	35.9	38.9 bu
Millet	1500	1370	1800	1182	1500	1888	1848	1000	1511	1558lb
Rotation 5a										
Winter Wheat	36.5	47.6	33.1	3.4	34.9	34.1	49.7	37.0	34.4	38.9 bu
Corn	100.9	50.2	101.6	0	0	54.9	50.0	0	44.6	51.0 bu
Sunflower	2010	1958	1443	250	722	455	680	N/A	N/A	1211 lb
S Wheat (99-04) to Barley (05-06)	36.3	31.8	28.4	1.6	26.2	0	41.6	15.8	28.7 (2 yrs)	28.7 bu (2 yrs)
Rotation 6a										
Winter Wheat-a	63.9	60.8	48.0	10.8	35.9	34.5	55.6	25.5	41.8	46.3 bu
Winter Wheat-b	34.1	48.9	33.0	5.2	35.4	24.7	52.5	26.5	32.5	36.4 bu
Sunflower (99-04) to Safflower(05-06)	2210	2468	2011	200	1132	818	651 saff	548 saff	600	1728 lb (5 yr) 599 lb (2 yr)
Pea Fallow (99-04) to Field Pea (05-06)	0-pf	0-pf	0-pf	0-pf	0-pf	0-pf	1405 fp	1308 fp	1356 (2 yrs)	0 1356lb (2 yrs)
Rotation 9a										
Winter Wheat-a	68.3	57.1	50.0	9.2	44.0	0	64.8	34.4	40.9	45.5 bu
Winter Wheat-b	29.8	43.0	38.2	4.9	31.7	27.5	56.8	35.2	33.3	37.4 bu
Safflower	1277	1546	1624	230	1106	617	885	516	975	1081 lb
Pea Fallow (99-04) to H. Vetch (05-06)	0-pf	0-pf	0-pf	0-pf	0-pf	0-pf	0 - hv	0-hv	0 0	0 0
Rotation 10										
Winter Wheat	65.1	48.9	40.8	13.1	58.7	22.5	45.0	33.5	40.9	44.9 bu
Chickpea			1585	95	667	976	292	800	735	864lb (5 yrs)
Millet	1500	1524	2000	622	925	1197	2000	900	1333	1435 lb
Rotation 11										
Winter Wheat	54.2	37.8	42.2	13.5	59.4	28.2	53.0	41.7	41.2	45.2 bu
Corn	99.2	60.2	106.4	0	39.7	76.6	55.0	0	56.3	62.4 bu
Millet	1500	1300	2000	829	0	1017	1634	600	1109	1150lb
Rainfall(Apr-Aug)	13.44"	8.20"	12.29"	5.59"	5.34"	9.20"	10.89"	5.72"		

N / A = Sunflowers were destroyed by deer when heads were 2" in diameter.

Table 73. Estimated Yield Goals of The Wall Rotation Study (1999-2007).

Crop	1999	2000	2001	2002	2003	2004	2005	2006	2007
Rotation 1									
Winter Wheat	60	60	60	60	60	60	60	55 bu	55 bu
Fallow	0	0	0	0	0	0	0	0	0
Rotation 2a									
Winter Wheat-a	60	60	60	60	60	60	60	60 bu	60 bu
Sunflower	2000	2000	2000	2000	2000	2000	2000	1600lb	1600 lb
Millet	2000	2000	2000	2000	2000	2000	1500	1200lb	1200lb
Winter Wheat-b	45	45	45	45	45	45	45	45 bu	45bu
Corn	80	80	80	80	80	80	80	80 bu	80 bu
Fallow	0	0	0	0	0	0	0	0	0
Rotation 3									
Winter Wheat	45	45	45	45	45	45	45	45 bu	45 bu
Safflower	1500	1500	2000	2000	2000	1500	1200	1200lb	1200 lb
Millet	2000	2000	2000	2000	2000	2000	1500	1500 lb	1500 lb
Rotation 4									
Winter Wheat	45	45	45	45	45	45	40	35 bu	35 bu
Millet	2000	2000	2000	2000	2000	2000	2000	1500 lb	1500lb
Rotation 5a									
Winter Wheat	45	45	45	45	45	45	40	40 bu	40 bu
Corn	80	80	80	80	80	80	70	80 bu	80 bu
Sunflower	2000	2000	2000	2000	2000	2000	1500	1300lb	1300lb
Spring Barley	n/a	n/a	n/a	n/a	n/a	n/a	50	60 bu	60 bu
Rotation 6a									
Winter Wheat-a	60	60	60	60	60	60	60	45 bu	45 bu
Winter Wheat-b	45	45	45	45	45	45	45	45 bu	45 bu
Safflower	n/a	n/a	n/a	n/a	n/a	n/a	1500	1200 lb	1200 lb
Dry Peas	n/a	n/a	n/a	n/a	n/a	n/a	1800	1800lb	1800 lb
Rotation 9a									
Winter Wheat-a	60	60	60	60	60	60	60	45 bu	45 bu
Winter Wheat-b	45	45	45	45	45	45	45	45 bu	45 bu
Safflower	1500	1500	2000	2000	2000	1500	1500	1200 lb	1200 lb
Hairy Vetch	n/a	n/a	n/a	n/a	n/a	n/a	--	--	--
Rotation 10									
Winter Wheat	45	45	45	45	45	45	45	45 bu	45 bu
Chickpea	n/a	n/a	n/a	1500	1500	1500	1500	1500 lb	1500 lb
Millet	2000	2000	2000	2000	2000	2000	2000	1500lb	1500 lb
Rotation 11									
Winter Wheat	45	45	45	45	45	45	45	45 bu	45 bu
Corn	80	80	80	80	80	80	80	80bu	80 bu
Millet	2000	2000	2000	2000	2000	2000	1500	1500 lb	1500 lb
Rainfall(Apr-Aug)	13.44"	8.20"	12.29"	5.59"	5.24"	9.20"	10.89"	5.72"	--

Table 74. Long-Term Economic Trends of The Wall Rotation Study (1999-2006) (Net Income - $ per Acre).

Rot	Crop	1999	2000	2001	2002	2003	2004	2005	2006	Average Net Return($) (1999-2006)
1	W. Wht	$90.54	$70.94	$10.04	$25.01	$116.40	$-30.23	$48.30	$21.88	$43.66
	Fallow	-59.62	-61.35	-57.03	-72.57	-66.64	-56.29	- 73.72	-59.50	-44.91
	Ave Inc.	15.46	$4.79	-23.49	-23.78	24.88	-43.26	- 13.71	-18.81	-.52
2a	W. Wht-a	82.99	95.54	40.94	42.76	107.49	21.04	96.03	63.14	68.74
	Sunflowe r	40.45	84.65	39.43	-109.29	-92.02	3.19	-80.10	-39.29	-19.12
	Millet	-27.28	4.37	-19.28	-57.29	-77.58	-73.57	-22.11	-76.21	-43.61
	W Wht-b	24.74	19.17	9.61	-69.50	39.15	-19.59	21.67	21.64	5.86
	Corn	36.30	-25.08	56.84	-160.22	-125.56	-14.84	-51.30	-133.25	-52.13
	Fallow	-47.40	-52.47	-62.28	-58.69	-52.82	44.25	63.08	-49.25	-26.94
	Ave Inc.	18.30	21.03	10.87	-68.70	-33.65	-21.33	-16.48	-35.53	-11.20
3	W. Wht	20.18	14.85	4.42	-72.08	34.93	-34.58	3.41	31.09	.28
	Safflower	-23.88	17.92	51.48	-84.25	-46.52	23.70	-33.35	-57.25	-19.01
	Millet	-27.28	11.01	-19.28	-1.81	-77.58	-45.38	7.12	-56.00	-26.15
	Ave Inc.	-10.32	14.59	12.20	-52.71	-29.72	-18.75	-7.60	-27.38	-14.96
4	W Wht	4.41	- 9.30	-11.92	-58.02	57.89	-15.32	-41.08	40.01	-4.16
	Millet	-28.73	9.27	-35.90	49.06	-48.44	0.25	3.96	-30.94	-10.18
	Ave Inc.	-12.16	-.01	-23.91	-4.48	4.72	-7.53	-18.56	4.53	-7.17
10	W. Wht	37.47	20.19	9.91	-62.61	69.60	-33.43	12.56	15.01	8.58
	Chickpea			72.63	-155.62	-14.54	87.41	-129.58	-20.73	-26.73
	Millet	-27.28	37.73	-19.28	-25.53	-62.01	-23.64	16.34	-29.77	-16.68
	Ave Inc.	11.16	-1.54	21.08	-81.25	- 2.31	10.11	-33.56	-11.83	-11.61
11	W. Wht	23.06	-1.29	16.24	-81.47	65.64	-15.14	7.31	37.08	8.93
	Corn	15.42	-34.38	73.78	-160.22	-62.72	-3.44	-51.30	-133.25	-44.51
	Millet	-27.85	13.60	-19.28	16.85	-87.98	-35.30	-9.53	-52.99	-25.31
	Ave Inc.	3.54	-7.35	23.57	-68.28	-28.35	-17.96	-17.84	-49.72	-20.29

Appendix 1 Detailed Cultural Practices for Each Rotation in 2006

Rotation 1
WINTER WHEAT / SUMMER FALLOW

Cost / A.	2006 Winter Wheat
$28.26	-Plant to Jagalene @ 62 3 lbs or 950,000 seeds/acre. Note: Seed was treated with Raxil MD. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0. on September 20, 2005.
23.15	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 45 lbN / Acre rate (15 gal/Acre). - April 4, 2006.
20.30	-Spray wheat w / 16 oz Starane + .3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
18.46	-Harvest 31.0 bu/A winter wheat – July 13, 2006 Test weight – 63.9 lb / bu (Protein content – 14.7%)
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$119.17	Total Cost of Winter Wheat Production

Rotation 1
WINTER WHEAT / *SUMMER FALLOW*

Cost / A.	2006 Summer Fallow
$10.25	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 6 oz / acre Banvel 4L. 8 gpA spray rate. – October 18, 2005.
10.25	- Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 6 oz / acre Banvel 4L. 8 gpA spray rate. – May 16, 2006
5.25	-Work w / 24" sweeps – June 21, 2006
5.25	-Work w / 12" sweeps. – August 3, 2006
28.50	-Land Charges 2006
$59.50	Cost of Summer Fallow

Rotation 1 SUMMARY 2006

Crop	Income		Expenses	Net Income Per Acre
Winter Wheat	$141.05	-	$119.17	= $ 21.88
Fallow	$ 0.00	-	$ 59.50	= $-59.50
	$141.05	-	$178.67	= $-37.62 / 2 = $ - 18.81

$ - 18.81 Average Income / acre for Rotation 1 - 2006

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Rotation 2a

WINTER WHEAT-A / SUNFLOWER / MILLET / WINTER WHEAT-B / CORN / FALLOW

Cost / A	2006 Winter Wheat-A
$28.26	-Plant to Jagalene @ 62.3 lbs or 950,000 seeds/acre. Note: Seed was treated with Raxil MD. Planted w / JD 610 drill at 10" rows + 6 gal / A liquid 10-34-0 on September 20, 2005.
23.15	-Top dress 28-0-0 liquid Nitrogen fertilizer on dormant winter wheat at 45 lbN / Acre rate (15 gal/Acre) - April 4, 2006.
20.30	-Spray wheat w / 16 oz Starane (Kochia) + .3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
23.34	-Harvest 49.8 bu/A winter wheat – July 13, 2006 Test weight – 64.7 lb / bu (Protein content – 14.3%)
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$124.05	Total Cost of Winter Wheat Production

Rotation 2a

WINTER WHEAT-A / *SUNFLOWER* / MILLET / WINTER WHEAT -B / CORN / FALLOW

Cost / A	2006 Sunflowers
$10.25	-Spray w / 16 oz Roundup Original Max + liq Ammonium Sulfate @ 50 ml / gal + 6 oz/A Banvel 4L. 8 gpA spray rate. – October 18, 2005
47.66	-Inject 28-0-0 + 10-34-0 (80 lbN / 30 lb P2O5) with injector implement set @ 20" row spacing. – November 9, 2005
17.70	-Spray w / Roundup Original Max @ 16 oz / acre + 50 ml / gal liquid Ammonium Sulfate + Spartan @ 4 ounces per acre 10 gpA spray rate – April 27, 2006.
24.61	-Planted to Mycogen 8N421 Nusun oil-type sunflowers @ 16,600 seeds / acre w / JD 7100 planter. Note: Seed was treated w / Cruiser for wire worm control – June 8, 2006.
8.98	-Spray w / 24 oz / acre Roundup Original Max+ liquid ammonium sulfate @ 50 ml/gal. 10 gpA spray rate. – June 9, 2006.
22.56	-Harvest 1030 lb / Acre Sunflowers – October 25, 2006. Test weight – 29.8 lb / bushel
50	-Soil Sampling / acre
28.50	-Land Charges 2006
$160.76	Total Cost of Sunflower Production

Rotation 2a

WINTER WHEAT-A / SUNFLOWER / *MILLET* /WINTER WHEAT-B / CORN / FALLOW

Cost / A	2006 Millet
$9.73	-Spray w / 16 oz Roundup Ultra Max + Liquid Ammonium Sulfate + 5 oz/A Banvel 4L . 8gpA spray rate. --May 1, 2006.
22.20	-Sprayed with 28-0-0 @ 30 lbN / acre + 16 oz Roundup Ultra Max + 5 oz Banvel 4L 10 gpa spray rate. – June 6, 2006.
25.50	-Planted to Sunup Proso millet w / JD750 drill. w/ starter fertilizer(10-34-0) at 6 gal / Acre. Row spacing was at 10". Seeding rate was at 18 lb/A. – June 7, 2006
13.78	-Harvest 300 lb / acre Millet – September 13, 2006.
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$100.21	Total Cost of Millet Production

Rotation 2a

WINTER WHEAT-A / SUNFLOWER / MILLET / *WINTER WHEAT-B* / CORN / FALLOW

Cost / A.	2006 Winter Wheat –B
$11.05	-Spray w / 20 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 6 oz / acre. 8 gpA spray rate. –September 14, 2005.
28.26	-Plant to Jagalene @ 62.3 lbs or 950,000 seeds/acre. Note: Seed was treated with Raxil MD. Planted w / JD 750 drill at 10" rows + 5 gal / A liquid 10-34-0. - September 28, 2005.
42.80	-Top dressed with 28-0-0 @ 90 lb N / acre. – April 4, 2006.
20.30	-Spray wheat w / 16 oz Starane (Kochia) + 3 oz / acre Harmony GT (mustards and wild buckwheat control) + 16 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
20.30	-Harvest 38.1 bu/A winter wheat – July 13, 2006. Test weight – 63.1 lb / bu (Protein content - 13.0%)
50	-Soil Sampling / acre
28.50	-Land Charges 2006
$151.71	Total Cost of Winter Wheat-B Production

Rotation 2a

WINTER WHEAT-A / SUNFLOWER / MILLET / WINTER WHEAT-B / *CORN* / FALLOW

Cost / A.	2006 Corn
$10.25	Spray w / 16 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 6 oz / acre. 8 gpA spray rate – October 18, 2005.
47.66	-Injected 28-0-0 + 10-34-0 (80 lbN/acre plus 30 lb P2O5 per acre). 20 inch row spacing. -November 9, 2005.
9.77	-Spray w / 16 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 5 oz / acre. 8 gpA spray rate – May 1, 2006.
22.84	-Plant to Econo Brand Dekalb RR/YG 90 day @ 12,500 seeds / acre Planted w / JD 7100 Corn planter. 20 inch row spacing. - May 4, 2006.
13.73	- Spray w / 24 oz Roundup Ultra Max + Liquid Ammonium Sulfate + 5 oz Banvel 4L. 8 gpA spray rate. – June 6, 2006.
0.00	-Harvest 0 bushels / acre corn – October 10, 2006
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$133.25	-Total Cost of Corn Production

Rotation 2a

WINTER WHEAT-A / SUNFLOWER / MILLET /WINTER WHEAT-B / CORN / *FALLOW*

Cost / A.	2006 Summer Fallow
$10.25	- Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 6 oz / acre Banvel 4L. 8 gpA spray rate. – May 16, 2006.
5.25	-Work w / 24" sweeps. – June 21, 2006.
5.25	-Work w / 12" sweeps – August 3, 2006.
28.50	-Land Charges 2006
$49.25	Total Cost of Summer Fallow

Rotation 2a SUMMARY 2006

Crop	Income	Expenses	Net Income Per Acre
Winter Wheat-A	$226.59	- $163.45 ($124.05 +$39.40)	= $ 63.14
Sunflower	$131.32	- $170.61 ($160.76 + $9.85)	= $ -39.29
Millet	$ 24.00	- $100.21	= $ -76.21
Winter Wheat-B	$173.35	- $151.71	= $ 21.64
Corn	$ 0.00	- $133.25	= $-133.25
Fallow	$ 0.00	- $ 0.00*	= $ 0.00*
	$555.26	- $719.23	= $-163.97 / 6 = $ - 27.32

*The expense of the fallow ($49.25) was split 80% to the Winter Wheat-A ($39.40) and 20% to the Sunflowers ($9.85)

$ - 27.32 Average Income / acre for Rotation 2a – 2006

Rotation 3
WINTER WHEAT / SAFFLOWER / MILLET

Cost / A	2006 Winter Wheat
$11.05	-Spray w / 20 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 6 oz / acre 8 gpA spray rate – September 14, 2005
28.26	-Plant to Jagalene @ 62.3 lbs or 950,000 seeds/acre. Note: Seed was treated with Raxil MD. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0 - September 28, 2005
42.80	-Top dressed with 28-0-0 @ 90 lb N / acre – April 4, 2006
20.30	-Spray wheat w / 16 oz Starane (Kochia) + 3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
20.86	-Harvest 40.3 bu/A winter wheat – July 13, 2006 Test weight – 64.2 lb / bu (Protein content - 12.1%)
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$152.27	Total Cost of Winter Wheat Production

Rotation 3
WINTER WHEAT / *SAFFLOWER* / MILLET

Cost / A	2006 Safflower
$16.41	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 2/3 of the 5.3 oz / A (3.5 oz) Spartan 75DF. 10 gpA spray rate. –October 19, 2005
38.89	-Injected 28-0-0 plus +10-34-0 (60 lbN/acre + 30 lb P2O5 / acre) - November 9, 2005.
12.02	-Spray w / Spartan 75DF @ 1.8 oz / A + Roundup Ultra Max @ 16 oz / A + liquid ammonium sulfate @ 50 ml / gal. 10 gpA spray rate. – April 27, 2006
19.70	-Plant to Finch w / JD 7100 planter @ 210,000 seeds/acre rate. (20 lbs/acre) – May 4, 2006
14.58	-Harvest 489 lb / Acre Safflowers – September 6, 2006. Test weight – 41.3 lb / bushel
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$130.60	Total Cost of Safflower Production

Rotation 3

WINTER WHEAT / SAFFLOWER / *MILLET*

Cost / A	2006 Millet
$9.73	Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 5 oz/A Banvel 4L 8gpA spray rate. –May 1, 2006
9.73	-Sprayed w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 5 oz/A Banvel 4L . 8 gpA spray rate. – June 6, 2006.
25.50	-Planted to Sunup Proso millet w / JD750 drill. w/ starter fertilizer(10-34-0) at 6 gal / Acre. Row spacing was at 10". Seeding rate was at 18 lb/A – June 7, 2006.
14.04	-Harvest 400 lb / acre Millet – September 13, 2006
50	-Soil Sampling / acre
28.50	-Land Charges 2006
$88.00	Total Cost of Millet Production

Rotation 3 SUMMARY 2006

Crop	Income		Expenses		Net Income Per Acre
Winter Wheat	$183.36	-	$152.27	=	$ 31.09
Safflower	$ 73.35	-	$130.60	=	$ - 57.25
Millet	$ 32.00	-	$ 88.00	=	$ - 56.00
	$288.71	-	$370.87	=	$ - 82.16 / 3 = $ - 27.38

$ - 27.38 Average Income / acre for Rotation 3 – 2006

Rotation 4

WINTER WHEAT / MILLET

Cost / A	2006 Winter Wheat
$11.05	-Spray w / 20 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 6 oz / acre. 8 gpA spray rate – September 14, 2005
28.26	-Plant to Jagalene @ 62.3 lbs or 950,000 seeds/acre. Note: Seed was treated with Raxil MD. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0 - September 28, 2005.
23.15	-Top dressed with 28-0-0 @ 45 lb N / acre – April 4, 2006
20.30	-Spray wheat w / 16 oz Starane (Kochia) + .3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
20.22	-Harvest 37.8 bu/A winter wheat – July 13, 2006 Test weight – 64.3 lb / bu (Protein content - 10.8%)
.50	Soil Sampling / acre
28.50	-Land Charges 2006
$131.98	Total Cost of Winter Wheat Production

Rotation 4
WINTER WHEAT / *MILLET*

Cost / A.	2006 Millet
$11.05	-Spray w / 20 oz Roundup Original Max + Liquid Ammonium Sulfate + 6 oz/A Banvel 4L 8gpA spray rate --September 1, 2005
10.25	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 6 oz/A Banvel 4L 8gpA spray rate. –October 18, 2005
9.77	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 5 oz/A Banvel 4L . 8gpA spray rate –May 1, 2006
9.77	-Sprayed w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 5 oz Banvel 4L 8 gpa spray rate – June 6, 2006.
25.50	-Planted to Sunup Proso millet w / JD750 drill. w/ starter fertilizer(10-34-0) at 6 gal / Acre Row spacing was at 10". Seeding rate was at 18 lb/A – June 7, 2006
15.60	-Harvest 1000 lb / acre Millet – September 13, 2006
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$110.94	Total Cost of Millet Production

Rotation 4 SUMMARY 2006

Crop	Income		Expenses		Net Income Per Acre
Winter Wheat	$171.99	-	$131.98	=	$ 40.01
Millet	$ 80.00	-	$110.94	=	$-30.94
	$251.99	-	$242.92	=	$9.07 / 2 = $ 4.53

$ 4.53 Average Income / acre for Rotation 4 – 2006

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Rotation 5a
WINTER WHEAT / CORN / SUNFLOWER / SPRING BARLEY

Cost / A.	2006 Winter Wheat
$28.26	-Plant to Jagalene @ 62.3 lbs or 950,000 seeds/acre Note: Seed was treated with Raxil MD. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0 - September 28, 2005.
29.70	-Top dressed with 28-0-0 @ 60 lb N / acre – April 4, 2006
20.30	-Spray wheat w / 16 oz Starane (Kochia) + 3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
20.02	-Harvest 37.0 bu/A winter wheat – July 13, 2006 Test weight – 62.1 lb / bu (Protein content - 13.5%)
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$127.28	Total Cost of Winter Wheat Production

Rotation 5a

WINTER WHEAT / *CORN* / SUNFLOWER / SPRING BARLEY

Cost/A	2006 Corn
$10.25	-Spray w / 16 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 6 oz / acre. 8 gpA spray rate. – October 18, 2005.
47.66	-Injected 28-0-0 + 10-34-0 (80 lbN/acre plus 30 lb P2O5 per acre) 20 inch row spacing. -November 9, 2005.
9.77	-Spray w / 16 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 5 oz / acre. 8 gpA spray rate. – May 1, 2006.
22.84	-Plant to Econo Brand Dekalb RR/YG 90 day @ 12,500 seeds / acre. Planted w / JD 7100 Corn planter 20 inch row spacing - May 4, 2006
13.73	- Spray w / 24 oz Roundup Ultra Max + Liquid Ammonium Sulfate + 5 oz Banvel 4L. 8 gpA spray rate. – June 6, 2006.
0.00	-Harvest 0 bushels / acre corn – October 10, 2006
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$133.25	Total Cost of Corn Production

Rotation 5a

WINTER WHEAT / CORN / *SUNFLOWER* / SPRING BARLEY

Cost / A	2006 Sunflower
$47.66	-Inject 28-0-0 + 10-34-0 (80 lbN / 30 lb P2O5) with injector implement set @ 20" row spacing – November 9, 2005
17.70	-Spray w / Roundup Original Max @ 16 oz / acre + 50 ml / gal liquid Ammonium Sulfate + Sparten @ 4 ounces per acre. 10 gpA spray rate. – April 27, 2006
24.61	-Planted to Mycogen 8N421 Nusun oil-type sunflowers @ 16,600 seeds / acre w / JD 7100 planter. Note: Seed was treated w / Cruiser for wire worm control – June 8, 2006
8.98	-Spray w / 24 oz / acre Roundup Original Max + liquid ammonium sulfate @ 50 ml/gal 10 gpA spray rate – June 9, 2006.
16.30	-Harvest 500 lb (estimated) / Acre Sunflowers – October 25, 2006 Test weight – 32.0 lb / bushel
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$144.25	Total Cost of Sunflower Production

Rotation 5a

WINTER WHEAT / CORN / SUNFLOWER / *SPRING BARLEY*

Cost / A	2006 Spring Barley
$23.15	-Top dressed with 28-0-0 @ 45 lb N / acre. – April 4, 2006
28.31	-Plant to Esfick Barley @ 117 lb or 1,220,000 seeds / acre rate. Seeded w / JD 750 drill. Starter fertilizer 10-34-0 was applied at 6 gallons per acre rate. – April 4, 2006.
20.30	-Spray wheat w / 16 oz Starane (Kochia) + .3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
15.04	-Harvest 15.8 bu/A Barley – July 13, 2006 Test weight –50.7 lb / bu (Protein content - 19.6%)
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$115.80	Total Cost of Spring Barley Production

Rotation 5a SUMMARY 2006

Crop	Income		Expenses		Net Income Per Acre
Winter Wheat	$168.35	-	$127.28	=	$ 41.07
Corn	$ 0.00	-	$133.25	=	$-133.25
Sunflower	$ 63.75	-	$144.25	=	$ -80.50
Spring Barley	$ 37.92	-	$115.80	=	$ -77.88
	$270.02	-	$520.58	=	$- 250.56 / 4 = $- 62.64

$ - 62.64 Average Income / acre for Rotation 5a - 2006

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Rotation 6a

WINTER WHEAT-B / SAFFLOWER / FIELD PEA / WINTER WHEAT-A

Cost / A.	2006 Winter Wheat -B
$11.05	-Spray w / 20 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 6 oz / acre 8 gpA spray rate. – September 1, 2005.
28.26	-Plant to Jagalene @ 62.3 lbs or 950,000 seeds/acre Note Seed was treated with Raxil MD Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 28, 2005.
23.15	-Top dressed with 28-0-0 @ 45 lb N / acre – April 4, 2006.
20.30	-Spray wheat w / 16 oz Starane (Kochia) + 3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
17.28	-Harvest 26.5 bu/A winterwheat – July 13, 2006 Test weight – 62.1 lb / bu (Protein content - 13.1%)
50	-Soil Sampling / acre
28.50	-Land Charges 2006
$129.04	Total Cost of Winter Wheat –B Production

Rotation 6a

WINTER WHEAT-B / *SAFFLOWER* / FIELD PEA / WINTER WHEAT-A

Cost / A.	2006 Safflower
$16.41	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 2/3 of the 5.3 oz / A (3.5 oz) Spartan 75DF. 10 gpA spray rate. –October 19, 2005.
38.89	-Injected 28-0-0 plus +10-34-0 (60 lbN/acre + 30 lb P2O5 / acre) - November 9, 2005.
12.02	-Spray w / Spartan 75DF @ 1.8 oz / A + Roundup Original Max @ 16 oz / A + liquid ammonium sulfate @ 50 ml / gal. 10 gpA spray rate. – April 27, 2006
19.70	-Plant to Finch w / JD 7100 planter @ 210,000 seeds/acre rate (20 lbs/acre). – May 4, 2006.
14.78	-Harvest 548 lb / Acre Safflowers – September 6, 2006. Test weight – 41.9 lb / bushel
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$130.80	Total Cost of Safflower Production

Rotation 6a

WINTER WHEAT-B / SAFFLOWER / *Field pea* / WINTER WHEAT-A

Cost / A	2006 Field pea
$16.41	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 2/3 of the 5.3 oz / A (3.5 oz) Spartan 75DF. 10 gpA spray rate. --October 19, 2005
38.49	-Plant to Grande peas @ 300,000 seeds per acre (140 lb/A) + 5 lb / acre granular innoculum w / JD 750 drill. No starter fertilizer added. – April 4, 2006.
16.06	-Harvest 1308 lb or 21.8 bushels/ Acre Grande peas – July 13, 2006. Test weight– 63.0 lb / bushel
28.50	-Land Charges 2006
$99.46	Total Cost of Field pea Production

Rotation 6a

WINTER WHEAT-B / SAFFLOWER / FIELD PEA / *WINTER WHEAT-A*

Cost / A.	2006 Winter Wheat – A
$28.26	-Plant to Jagalene @ 62.3 lbs or 950,000 seeds/acre. Note: Seed was treated with Raxil MD. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 28, 2005.
0.00	- Note: Soil tests indicated that no nitrogen fertilizer was needed for this crop. – April 4, 2006.
20.30	-Spray wheat w / 16 oz Starane (Kochia) + .3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
17.02	-Harvest 25.5 bu/A winter wheat – July 13, 2006. Test weight – 63.4 lb / bu (Protein content - 15.0%)
50	-Soil Sampling / acre
28.50	-Land Charges 2006
$94.58	Total Cost of Winter Wheat-A Production

Rotation 6a SUMMARY 2006

Crop	Income		Expenses	Net Income Per Acre
Winter Wheat -B	$120.57	-	$148.93 (129.04 + $19.89)	= $-28.36
Safflower	$ 82.20	-	$130.80	= $-48.60
Field pea	$ 78.48	-	$ 0.00	= $ 78.48
Winter Wheat -A	$116.02	-	$174.15 (94.58 + 79.57)	= $ 58.13
	$397.27	-	$453.88	= $ - 56.61 / 4 = $ -14.15

*The expense of the field pea ($99.46) was split 80% ($79.57) to the Winter Wheat-A and 20% ($19.89) to the Winter Wheat-B

$ - 14.15 Average Income / acre for Rotation 6a - 2006

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Rotation lb7

The plots from rotation #7 (WW-Corn-Fallow) were combined with rotation #2 (WW-Sunflower-Millet) to make a longer six year rotation (2a) in 1999.

Rotation #8

The plots from rotation #8 were added to rotations 5, 6 and 9 to make longer 4 year rotations in 1998.

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Rotation 9a

WINTER WHEAT -B / SAFFLOWER / Hairy Vetch / WINTER WHEAT-A

Cost / A	2006 Winter Wheat –B
$11.05	-Spray w / 20 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 6 oz / acre 8 gpA spray rate. – September 1, 2005
28.26	-Plant to Jagalene @ 62 3 lbs or 950,000 seeds/acre Note. Seed was treated with Raxil MD. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 28, 2005.
29.70	-Top dressed with 28-0-0 @ 60 lb N / acre. – April 4, 2006.
20 30	-Spray wheat w / 16 oz Starane (Kochia) + .3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
19.54	-Harvest 35.2 bu/A winter wheat – July 13, 2006 Test weight – 62.1 lb / bu (Protein content - 12.5%)
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$137 85	Total Cost of Winter Wheat–B

Rotation 9a

WINTER WHEAT-B / *SAFFLOWER* / Hairy Vetch / WINTER WHEAT-A

Cost / A	2006 Safflower
$16 41	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 2/3 of the 5 3 oz / A (3 5 oz) Spartan 75DF. 10 gpA spray rate --October 19, 2005.
38 89	-Injected 28-0-0 plus +10-34-0 (60 lbN/acre + 30 lb P2O5 / acre) - November 9, 2005.
12 02	-Spray w / Spartan 75DF @ 1 8 oz / A + Roundup Original Max @ 16 oz / A + liquid ammonium sulfate @ 50 ml / gal. 10 gpA spray rate – April 27, 2006
19 70	-Plant to Finch w / JD 7100 planter @ 210,000 seeds/acre rate (20 lbs/acre) – May 4, 2006
14.67	-Harvest 516 lb / Acre Safflowers – September 6, 2006. Test weight – 42 5 lb / bushel
50	-Soil Sampling / acre
28 50	-Land Charges 2006
$130 69	Total Cost of Safflower Production

Rotation 9a

WINTER WHEAT-B / SAFFLOWER / *Hairy Vetch* / WINTER WHEAT-A

Cost / A	2006 Hairy Vetch
$9.35	-Spray w / 16 oz Roundup Original Max + 50 ml / gal liquid Ammonium Sulfate + 12 oz LV6 8 gpA spray rate. – October 7, 2004.
47 49	-Plant to Hairy Vetch @ (20 lb/A) + 5 lb / acre granular pea/lentil inoculum w / JD 750 drill. – April 4, 2006.
11 17	-Spray to terminate hairy vetch w / 16 oz Roundup Original Max + 50 ml / gal liquid ammonium sulfate + 8 oz / A Banvel 4L. 8 gpA spray rate. – June 21, 2006.
28 50	-Land Charges 2006
$96.51	Total Cost of Hairy Vetch

Rotation 9a

WINTER WHEAT-B / SAFFLOWER / HAIRY VETCH / *WINTER WHEAT-A*

Cost / A	2006 Winter Wheat-A
$28.26	-Plant to Jagalene @ 62.3 lbs or 950,000 seeds/acre Note: Seed was treated with Raxil MD. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 28, 2005.
23.15	-Top dressed with 28-0-0 @ 45 lb N / acre. – April 4, 2006.
20.30	-Spray wheat w / 16 oz Starane (Kochia) + .3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
19.34	-Harvest 34.4 bu/A winter wheat – July 13, 2006 Test weight – 63.1 lb / bu (Protein content –14.9%)
.50	-Soil Sampling / acre
28.50	Land Charges 2006
$120.05	Total Cost of Winter Wheat-A Production

Rotation 9a SUMMARY 2006

Crop	Income	Expenses	Net Income Per Acre
Winter Wheat-B	$160.16 -	$157.15 ($137.85 + $19.30)	= $ 3.01
Safflower	$ 77.40 -	$130.69	= $ - 53.29
Hairy Vetch	$ 0.00 -	$ 0.00	= $ 0.00*
Winter Wheat-A	$156.52 -	$197.26 ($120.05 + $77.21)	= $ - 40.74
	$394.08 -	$485.10	= $ - 91.02 / 4 = $-22.75

*The expense of the hairy vetch ($96.51) was split 80% ($77.21) to the Winter Wheat-A and 20% ($19.30) to the Winter Wheat-B.

$ - 22.75 Average Income / acre for Rotation 9a - 2006

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Rotation 10

WINTER WHEAT / CHICKPEA / MILLET

Cost / A.	2006 Winter Wheat
$11.05	-Spray w / 20 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 6 oz / acre 8 gpA spray rate – September 14, 2005.
28.26	-Plant to Jagalene @ 62.3 lbs or 950,000 seeds/acre. Note: Seed was treated with Raxil MD. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0 - September 28, 2005.
29.70	-Top dressed with 28-0-0 @ 60 lb N / acre – April 4, 2006
20.30	-Spray wheat w / 16 oz Starane (Kochia) + .3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006
19.10	-Harvest 33.5 bu/A winter wheat – July 13, 2006 Test weight – 65.4 lb / bu (Protein content –10.9%)
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$137.41	Total Cost of Winter Wheat Production

Rotation 10

WINTER WHEAT / *CHICKPEA* / MILLET

Cost / A.	2006 Chick Peas
$11.05	-Spray w / 20 oz Roundup Original Max + Liquid Ammonium Sulfate + 6 oz/A Banvel 4L 8gpA spray rate --September 1, 2005
16.41	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 2/3 of the 5.3 oz / A (3.5 oz) Spartan 75DF 10 gpA spray rate. –October 19, 2005.
79.89	-Plant to Sierra Chickpeas @ 130,000 seeds per acre (120 lb/A) (1080 seeds / lb) + 5 lb / acre granular innoculum w / JD 750 drill No starter fertilizer added – April 17, 2006
14.72	-Harvest 800 lb or 13.3 bushels / Acre Sierra chickpeas August 3, 2006
28.50	-Land Charges 2006
$150.57	Total Cost of Chickpea Production

Rotation 10

WINTER WHEAT / CHICKPEA / *MILLET*

Cost / A	2006 Millet
$9.73	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 5 oz/A Banvel 4L . 8gpA spray rate –May 1, 2006.
22.20	-Sprayed with 28-0-0 @ 30 lbN / acre + 16 oz Roundup Ultra Max + 5 oz Banvel 4L . 10 gpa spray rate – June 6, 2006.
25.50	-Planted to Sunup Proso millet w / JD750 drill w/ starter fertilizer(10-34-0) at 6 gal / Acre Row spacing was at 10" Seeding rate was at 18 lb/A. – June 7, 2006
15.34	-Harvest 900 lb / acre Millet – September 13, 2006
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$101.77	Total Cost of Millet Production

Rotation 10 SUMMARY 2006

Crop	Income		Expenses	Net Income Per Acre
Winter Wheat	$152.42	-	$137.41	= $ 15.01
Chickpea	$129.84	-	$150.57	= $- 20.73
Millet	$ 72.00	-	$101.77	= $- 29.77
	$354.26	-	$389.75	= $- 35.49 / 3 = $ - 11.83

$ - 11.83 Average Income / acre for Rotation 10 - 2006

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Rotation 11

WINTER WHEAT / CORN / MILLET

Cost / A.	2006 Winter Wheat
$11.05	-Spray w / 20 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 6 oz / acre 8 gpA spray rate. – September 14, 2005.
28.28	-Plant to Jagalene @ 62.3 lbs or 950,000 seeds/acre Note: Seed was treated with Raxil MD. Planted w / JD 750 drill at 10" rows + 6 gal / A liquid 10-34-0. - September 28, 2005
42.80	-Top dressed with 28-0-0 @ 90 lb N / acre. – April 4, 2006
20.30	-Spray wheat w / 16 oz Starane (Kochia) + .3 oz / acre Harmony GT (mustards and wild buckwheat control) + 18 ml / gal Penetrate II. 8 gpA spray rate. – May 11, 2006.
21.24	-Harvest 41.7 bu/A winter wheat – July 13, 2006 Test weight – 64.6 lb / bu (Protein content – 12.0%)
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$152.65	Total Cost of Winter Wheat Production

Rotation 11
WINTER WHEAT / *CORN* / MILLET

Cost / A	2006 Corn
$10.25	-Spray w / 16 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 6 oz / acre 8 gpA spray rate. – October 18, 2005.
47.66	-Injected 28-0-0 + 10-34-0 (80 lbN/acre plus 30 lb P2O5 per acre). 20 inch row spacing -November 9, 2005.
9.77	-Spray w / 16 oz Roundup Original Max + liquid Ammonium Sulfate at 50 ml/gal + Banvel 4L @ 5 oz / acre 8 gpA spray rate – May 1, 2006
22.84	-Plant to Econo Brand Dekalb RR / YG 90 day @ 12,500 seeds / acre. Planted w / JD 7100 Corn planter 20 inch row spacing - May 4, 2006
13.73	- Spray w / 24 oz Roundup Ultra Max + Liquid Ammonium Sulfate + 5 oz Banvel 4L 8 gpA spray rate – June 6, 2006.
0.00	-Harvest 0 bushels / acre corn – October 10, 2006
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$133.25	Total Cost of Corn Production

Rotation 11
WINTER WHEAT / CORN / *MILLET*

Cost / A	2006 Millet
$9.73	-Spray w / 16 oz Roundup Original Max + Liquid Ammonium Sulfate + 5 oz/A Banvel 4L 8gpA spray rate. –May 1, 2006.
22.20	-Sprayed with 28-0-0 @ 30 lbN / acre + 16 oz Roundup Original Max + 5 oz Banvel 4L 10 gpa spray rate. – June 6, 2006
25.50	-Planted to Sunup Proso millet w / JD750 drill. w/ starter fertilizer(10-34-0) at 6 gal / Acre Row spacing was at 10". Seeding rate was at 18 lb/A – June 7, 2006.
14.56	-Harvest 600 lb / acre Millet – September 13, 2006.
.50	-Soil Sampling / acre
28.50	-Land Charges 2006
$100.99	Total Cost of Millet Production

Rotation 11 SUMMARY 2006

Crop	Income		Expenses		Net Income Per Acre
Winter Wheat	$189.73	-	$152.65	=	$ 37.08
Corn	$ 0.00	-	$133.25	=	$-133.25
Millet	$ 46.00	-	$100.99	=	$ -52.99
	$237.73	-	$386.89	=	$ -149.16 / 3 = $ -49.72

$ - 49.72 Average Income / acre for Rotation 11 - 2006

****

COST OF INPUTS – 2006

SEED

Jagalene Winter Wheat.....$ 7.00 / Bu
Eslick Barley.....$ 3.00 / Bu
Grande field peas.....$ 9.00 / Bu
Sierra Kabuli Chickpea.....$52.00 / 100 lbs
(Note: the seed is treated w/ LSP / Apron / Maxim)
Finch Safflower.....$23.00 / 50 lbs
Dekalb DKC Econo Brand RR/YG Corn.$79.00 / bag
(80,000 kernels)
Mycogen 8N421Sunflower – Size 3....$170.00 / bag
(200,000 seeds)
Sunup Millet.....$ .25 / lb
Hairy Vetch.....$ 1.50 / lb

HERBICIDES

(From Wame Chemical, Rapid City, SD – Dec, 2006)
Roundup Ultra Max.....$38.50 / gal
Bronate (Brox M).....$39.58 / gal
Roundup Original Max.....$25.96 / gal
Atrazine 90df.....$ 2.33 / lb
Harmony GT.....$12.90 / oz
Harmony Extra (Affinity TM)$15.20 / oz
Ally.....$24.21 / oz
Treflan 10% granules.....$ 0.83 / lb
2,4D Ester LV6.....$21.32/gal
Clarity (dicamba).....$62.50 / gal
Poast.....$69.30 / gal
Spartan 75df.....$41.32/ lb ($2.58 /oz)
Spartan 4F.....$386/gal
Starane.....$97.89/gallon
Maverick.....$14.80 / oz
Olympus WG.....$10.94 / oz
Olympus Flex.....$ 3.65 / oz
Aim.....$171.42 / quart ($5.35 / oz)
Cleanwave.....$46.20/gallon
Crop Oil.....$ 6.60/gal
Penetrate II.....$18.50/gal
Ammonium Sulfate.....$ 6.06/gal

INSECTICIDES

Lorsban 4E.....$37.88 / gallon

FUNGICIDES

Tilt.....$340.00 / gallon

FERTILIZER

(Johnson's Ranchers Supply, Wall, SD– Nov, 2005)
10-34-0.....$300.00 / Ton ($1.75/gallon)
(Johnson's Ranchers Supply, Wall, SD – March 2006)
28-0-0.....$245.00 / Ton ($1.31/ gallon)

SEED TREATMENTS

Granular Inoculum for peas.....$65.95 / 40 lb bag
Vitavax/Thiram/RTU.....$23.41 / gal
Seed treatment fee.....$ .25 / acre
Field Pea/Vetch innoculum.(peat base)..$ .60 / bu

EQUIPMENT CHARGES

Planting.....$10.50 / acre
Mechanical Tillage.....$ 5.25 / acre

Spray Application
Herbicide.....$ 3.50 / acre
Fertilizer.....$ 3.50 / acre
Treflan Granules.....$ 3.00 / acre

Harvest
Base.....$13.00 / acre
Over 20 bu/acre.....$ .13 / bu
Trucking.....$ .13 / bu

Soil Sampling & Analysis.....$ .50 / acre

LAND CHARGES

$350 / A x .07=$24.50 + $4 land tax=$28.50/Acre

GRAIN SALE VALUES

(Grain Prices for 2006 crop from Dakota Mill & Grain, Rapid City, SD - December 7, 2006)

Winter Wheat.....$4.55 / bushel
Sierra Chickpeas.....See Chart on next page.
Sunflower (oil-type).....($12.75 + $0.00 LDP) $12.75 /cwt.
Corn #2 yellow.....($3.30 + $0.00 LDP) $3.30 / bu
Safflower.....$15.00 / cwt
Proso Millet.....$ 8.00 / cwt
Barley.....($2.40 + $0.00 LDP) $2.40 / bushel
Field peas.....($3.60 + $0.00 LDP) $3.60 / bu
(price quote from Harrold Grain, Dec 11, 2006)

Sierra Chickpea Values from Hinrichs Trading,
Pullman, Washington
(As of December 11, 2006)

Seed Size	Percentage and Seed Value / Pound		
22/64" round	33% of 800 lb @ $0.26	=	$68.64
20/64" round	43% of 800 lb @ $0.15	=	$51.60
18/64" round	24% of 800 lb@ $0.05	=	$9.60
	Total crop value per acre	=	$ 129.84

Precipitation for September 2001 through August 2006

Wall Rotation Rain-Fall Data (2001-02)

Month	Total Precip. (inches)	Month	Total Precip. (inches)	Month	Total Precip. (inches)
September 01	0.82"	January 02	0.11"	*May*	1.41"
October	0.42"	February	0.05"	*June*	0.58"
November	0.02"	March	0.23"	*July*	0.79"
December	0.00"	*April*	0.92"	*August*	1.89"

(Accumulative total precipitation from Sept.1, 2001 to Aug. 31, 2002 is 7.24 ")
(Accumulative total precipitation from Apr.1 to Aug. 31, 2002 is 5.59")

Wall Rotation Rain-Fall Data (2002-03)

Month	Total Precip. (inches)	Month	Total Precip. (inches)	Month	Total Precip. (inches)
September 02	2.61"	January 03	0.14"	*May*	1.55"
October	0.73"	February	0.32"	*June*	0.66"
November	0.01"	March	1.35"	*July*	0.74"
December	0.03"	*April*	1.88"	*August*	0.41"

(Accumulative total precipitation from Sept.1, 2002 to Aug. 31, 2003 is 10.43 ")
(Accumulative total precipitation from Apr.1 to Aug. 31, 2003 is 5.24")

Wall Rotation Rain-Fall Data (2003-04)

Month	Total Precip. (inches)	Month	Total Precip. (inches)	Month	Total Precip. (inches)
September 03	1.22"	January 04	0.08"	*May*	3.62"
October	0.43"	February	0.02"	*June*	2.05"
November	0.09"	March	0.30"	*July*	2.35"
December	0.03"	*April*	0.19"	*August*	0.99"

(Accumulative total precipitation from Sept.1, 2003 to Aug. 31, 2004 is 10.79 ")
(Accumulative total precipitation from Apr.1 to Aug. 31, 2004 is 9.20 ")

Wall Rotation Rain-Fall Data (2004-05)

Month	Total Precip. (inches)	Month	Total Precip. (Inches)	Month	Total Precip. (inches)
September 04	3.48"	January 05	0.03"	*May*	4.75"
October	0.76"	February	0.00"	*June*	1.95"
November	0.08"	March	0.50"	*July*	1.82"
December	0.07"	*April*	1.35"	*August*	1.02"

(Accumulative total precipitation from Sept.1, 2004 to Aug. 31, 2005 is 15.81 ")
(Accumulative total precipitation from Apr.1 to Aug. 31, 2005 is 10.89 ")

Wall Rotation Rain-Fall Data (2005-06)

Month	Total Precip. (inches)	Month	Total Precip. (Inches)	Month	Total Precip. (Inches)
September 05	0.39"	January 06	0.17"	*May*	1.21"
October	0.63"	February	Missing	*June*	1.08"
November	0.24"	March	Missing	*July*	0.89"
December	0.28"	*April*	1.36"	*August*	1.18"

(Accumulative total precipitation from Sept.1, 2005 to Aug. 31, 2006 is 7.43" + missing data in Feb and Mar.)
(Accumulative total precipitation from Apr.1 to Aug. 31, 2006 is 5.72 ")

1971-2000 Average Total Precipitation from September 1 – August 31 is 17.24"
1971-2000 Average Total Precipitation from April 1 – August 31 is 11.53"

Wall Rotation Study Soil Analysis - As of December 20, 2006 for the 2007 Season.

Plot No.	2007 Crop and estimated yield goal	Soil Texture	Soil pH	Soluble Salts	Organic Matter %	NO3-N lb / acre 0-6" 0-24"		P ppm	K ppm	Add N lb/A	Add P205 lb/A	Add K2O lb/A	2006 Yield (Bushels/A or Lbs / acre)
						top	total						
101-1	Fallow	Medium	6 3	0 3	1 7	9	101	12	408	—	—	—	31 bu HRW
102-1	HRW-55bu	Medium	6.7	0 4	1 8	16	102	11	415	35	20	0	Fallow
117-2a	Sunf 1600 lb	Medium	6 5	0 3	2 1	8	74	20	591	5	0	0	49 8 bu HRW-a
118-2a	Mil-1200 lb	Medium	6 6	0 3	2 1	12	53	11	529	0	5	0	1030 lb Sunflower
119-2a	HRW-45bu	Medium	6 6	0 4	2 0	20	90	21	505	20	0	0	300 lb Millet
103-2a	Corn-80bu	Medium	6 8	0 5	1 9	26	137	18	469	0	0	0	38 1 bu HRW-b
104-2a	Fallow	Medium	6 8	0 5	1 7	22	119	16	435	—	—	—	0 bu Corn
105-2a	HRW-60bu	Medium	6 4	0 3	1 9	21	154	20	453	0	0	0	Fallow
106-3	Saff-1200 lb	Medium	6 4	0 3	1 9	10	68	15	437	0	0	0	40 3 bu HRW
107-3	Mil-1500 lb	Medium	6 7	0 4	1 9	10	64	11	420	0	5	0	489 lb Safflower
108-3	HRW-45bu	Medium	6 6	0 3	1 9	14	71	20	457	40	0	0	400 lb Millet
109-4	Mil-1500 lb	Medium	6 5	0 4	2 2	15	59	19	464	0	0	0	37 8 bu HRW
110-4	HRW-35bu	Medium	6 5	0 3	2 3	14	42	22	470	45	0	0	1000 lb Millet
111-5a	Sunf 1300 lb	Medium	6 5	0 4	1 9	34	108	27	456	0	0	0	0 bu Corn
122-5a	Barley60bu	Medium	6 3	0 4	2 0	31	119	16	512	0	0	0	500 lb Sunflower
112-5a	HRW-40bu	Medium	6 4	0 4	1 9	30	154	18	431	0	0	0	15 8 bu Barley
113-5a	Corn-80bu	Medium	6 6	0 3	1 8	9	90	13	445	5	10	0	37 0 bu HRW
114-6a	F Pea-1800 lb	Medium	6 7	0 4	1.7	16	88	9	468	0	15	0	548 lb Safflower
115-6a	HRW-45bu	Medium	6.7	0 4	1 7	11	74	9	462	0	20	0	1308 lb dry pea
121-6a	HRW-45bu	Medium	6 4	0 3	2.0	16	84	13	448	30	10	0	25.5 bu HRW-a
116-6a	Saff-1200 lb	Medium	6 6	0 3	2 0	10	53	18	469	5	0	0	26 5 bu HRW-b
123-9a	Hairy Vetch	Medium	6 5	0 3	1 8	14	94	16	427	—	—	—	516 lb Safflower
124-9a	HRW-50bu	Medium	6 7	0 4	1 8	19	133	8	476	0	25	0	HVetch g manure
125-9a	HRW-45bu	Medium	6 4	0 4	1 7	27	186	15	408	0	5	0	34 4 bu HRW-a
120-9a	Saff-1200 lb	Medium	6 5	0 3	2 1	14	69	11	509	0	10	0	35 2 bu HRW-b
126-10	C Pea-1500 lb	Medium	6 7	0.5	1 9	15	75	22	472	0	0	0	33 5 bu HRW
127-10	Mil-1500 lb	Medium	6 7	0 4	1 9	11	65	9	447	0	10	0	800 lb Chickpeas
128-10	HRW-45bu	Medium	6 6	0 4	2 1	14	68	13	476	45	10	0	900 lb Millet
129-11	Corn-80bu	Medium	6 6	0 4	2 1	26	103	16	473	0	0	0	41.7 bu HRW
130-11	Mil-1500 lb	Medium	6 6	0 3	2 0	14	85	11	432	0	5	0	0 bu Corn
131-11	HRW-45bu	Medium	6 3	0 4	2.1	28	96	20	452	15	0	0	600 lb Millet

Note: to convert P & K values to lb/A take ppm value x 2.
Example: 500 ppm is equal to 1000 lb/Acre

2006 Wall Rotation Yields, Expense/Acre, Break-Even Costs & Break-Even Yields

Rotation & Net return/A	Crop	(A) Yield	(B) Expense of Crop/Acre	(C) Cost of Production	(D) Yield to Break-Even
1	W Wheat	31.0 bu	$119.17+59.50	$5.76 /bu	39.2 bu
($-18.81)	Fallow at $59.50 /acre.				
2a	W Wheat-A	49.8 bu	$124.05+39.40	$3.28 /bu	35.9 bu
($-27.32)	Sunflower	1030 lb	$160.76+9.85	$.16 / lb	1338 lb
	Millet	300 lb	$100.21	$.33 / lb	1252 lb
	W Wheat-B	38.1 bu	$151.71	$3.98 /bu	33.3 bu
	Corn	0.0 bu	$133.25	N/A	40.3 bu
	Fallow at $49.25 / acre.		($39.40 + $9.85)*		
3	W Wheat	40.3 bu	$152.27	$3.77/bu	33.4 bu
($-27.38)	Safflower	489 lb	$130.60	$.26 / lb	870 lb
	Millet	400 lb	$ 88.00	$.22 / lb	1100 lb
4	W Wheat	37.8 bu	$131.98	$3.49 /bu	29.0 bu
($4.53)	Millet	1000 lb	$110.94	$.11/ lb	1386 lb
5a	W Wheat	37.0 bu	$127.28	$3.44 /bu	27.9 bu
($-62.64)	Corn	0.0 bu	$133.25	N/A	40.3 bu
	Sunflower	500 lb(est)	$144.25	$.28 / lb	1131 lb
	Barley	15.8 bu	$115.80	$7.32/bu	48.2 bu
6a	W Wheat-B	26.5 bu	$129.04	$4.86 /bu	28.3 bu
($-14.15)	Safflower	548 lb	$130.80	$.23 / lb	872 lb
	Field Pea	21.8 bu	$ 99.46	$4.56 /bu	27.6 bu
	W Wheat-A	25.5 bu	$ 94.58	$3.70 /bu	20.7 bu
9a	W Wheat-B	35.2 bu	$137.85+19.30	$4.46 /bu	34.5 bu
($-22.75)	Safflower	516 lb	$130.89	$.25 / lb	871 lb
	Hairy Vetch (green fallow)		($77.21+ $19.30)*		
	W Wheat-A	34.4 bu	$120.05+77.21	$5.73 / lb	43.3 bu
10	W Wheat	33.5 bu	$137.41	$4.10 /bu	30.2 bu
($-11.83)	Chickpea	800 lb	$150.57	$.19 / lb	929 lb
	Millet	900 lb	$101.77	$.11 / lb	1272 lb
11	W Wheat	41.7 bu	$152.65	$3.66 /bu	33.5 bu
($-49.72)	Corn	0.0 bu	$133.25	N/A	40.3 bu
	Millet	600 lb	$100.99	$.16 / lb	1262 lb

Grain Values for determining Yield to Break-Even Point (E)

Winter Wheat	$4.55 / bu	Corn	$3.30 / bu
Chickpea	$9.76 / bu	Millet	$.08 / lb
Sunflower	$.1275/lb	Safflower	$.15/lb
Barley	$2.40 / bu	Field Pea	$3.60 / bu

C = B / A **D = B / E**

*The fallow expense was separated at 80% for the first crop year and 20% to the second crop year.

Note: Winter Wheat values are all the same this year($4.55/bushel). There is no protein premium in 2006

(2006 Total Precipitation) April-1.36" May-1.21" June-1.08" July-0.89" August-1.18"

WALL ROTATION STUDY WEED COUNTS

Objectives: 1) To determine weed pressure and weed intensity in each rotation.
2) To determine the effects of crop rotations on weed control.

Procedures: All 124 plots of the Wall Rotation Study were evaluated (visually rated) for weed species presence and weed density on April 15, July 15, and October 15, 2006. A rating of zero (**0**) means that the plot was completely weed free. A rating of five (**5**) indicates that the plot was totally covered with weeds. The **Weed Rating Score** is derived from adding up the weed scores in the four plots with the same treatment and dividing by 4. The **Rotation Weed Mean** is derived from adding up weed scores for each crop in the rotation and dividing by the number of cropping treatments in each rotation. The lower the **Weed Rating** score and **Rotation weed mean**, the lower the incidence of weeds.

Discussion: There are approximately 35 weed species that have been identified at this rotation study. Approximately half of these weeds are of major economic importance and are directly competing with the crops at some point for valuable moisture, nutrients and sunlight. The overall highest incidence of weeds in 2006 was observed during the July 15th rating (Table 75). The second highest weed pressure was seen on the April 15 date. The fewest weeds present were again seen at the October 2006 date just like was observed in 2004 and 2005. In 2004, the highest weed pressure overall in the study was also seen on July 15th. In 2005 the highest incidence for weeds was at the April 15th rating date. Although weed pressure is lowest in the fall, this is an excellent time to control winter annual weeds. Table 76 shows the 3 year averages of 2004-2006. This table shows how the individual rotations perform in terms of longer term weed control. Table 75 shows each crop rotation rank and rating of weed pressure by date for 2006. Again, the smaller the number, the cleaner or less weeds the rotation had. Rotation 1 (wheat/fallow) was the cleanest on April 15, 2006. The cleanest rotation as of July 15,2006 was Rotation 5a (Wheat/Corn/Sunflower/Barley). The cleanest rotation as of October 15, 2006 was Rotation 10 (Wheat/Chickpea/Millet). Overall, the cleanest rotation in 2006 was Rotation 5a. This is largely due to the fact that Rotation 5a is very moisture intensive and the weed load was shut off due to lack of precipitation. Table 78 lists the weeds at the Wall Rotation, their origin and characteristics.

The rotation in 2006 with the most weed pressure was Rotation 4 (Wheat/millet). This rotation was also the weediest in 2004 and 2005. This rotation has about 11 months of fallow period between harvest of the wheat crop to planting of the millet crop. This non-crop period has proven to be problematic. Rotation 4 requires more sprayings per summer than the other millet plots in this study. Crown rot disease and weed problems are an ongoing problem in this rotation. Soil moisture is not being properly utilized in this rotation.

Weed pressure in the rotations will vary from year to year depending upon soil and air temperature, rainfall, canopy cover, mechanical tillage, and types of herbicides used and timing of planting. Ultimately, it is important to get a thorough weed cleansing at least one time during the crop season and/or during the fallow periods. Every crop in this rotation has a fallow period of at least a few months where there is no crop growing. It is critical to get good weed control during these opportunity windows of the fallow periods. Spraying pre-plant of the crops and also in the late fall are excellent times to keep weed populations in check. It is important to be versatile on herbicide options. We have inadvertently selected for ALS resistant Kochia in this study in the past by continued use of sulfonylurea herbicides. Every winter wheat and barley plot in the entire study was sprayed with Starane/Harmony GT on May 11, 2006. ALS resistant Kochia is prevalent in this study. Starane/Harmony GT did an excellent job of cleaning up the plots.

Table 75. Wall Rotation Weed Rating Scores and Rankings-2006.

Rotation	Rank as of 4-15-06	Apr 15, 2006 rating	Rank as of 7-15-06	July 15, 2006 rating	Rank as of 10-15-06	Oct 15, 2006 rating	Overall Rank Apr, Jul, Oct of 2006	**Total weed pressure- (Apr 15, July 15, Oct 15) of 2006**
1	1st	.312	3rd	.500	8th	1.125	3rd	1.937
2a	6th	.729	3rd	.500	5th	.708	3rd	1.937
3	7th	1.125	2nd	.458	2nd	.333	2nd	1.916
4	8th	1.562	5th	.9375	3rd	.437	8th	2.936
5a	3rd	.406	1st	.375	6th	.781	1st	1.562
6a	3rd	.406	7th	1.281	3rd	.437	6th	2.124
9a	4th	.531	6th	1.031	4th	.468	5th	2.030
10	5th	.583	8th	1.583	1st	.291	7th	2.457
11	2nd	.375	4th	.791	7th	.791	4th	1.957
		6.029		7.456		5.371		

Table 76. Wall Rotation Weed Rating Scores and Rankings-(2004, 05, 06).

Rotation	Average for April 15, (2004, 05, 06)	Average for July 15, (2004, 05, 06)	Average for October 15, (2004, 05, 06)	Total Weed Pressure of 4-15, 7-15, 10-15 for 2004, 2005, 2006	Overall Rank
1	.9	1.3	.6	2.7	6
2a	1.3	.9	.7	2.9	8
3	1.0	1.0	.6	2.5	4
4	2.1	1.6	.8	4.5	9
5a	1.0	.7	.7	2.4	2
6a	.8	1.3	.6	2.7	5
9a	.6	.7	.4	1.7	1
10	.8	1.3	.3	2.4	3
11	1.1	1.1	.7	2.8	7
	9.6	9.8	5.3		

Discussion: After 3 years of ratings, rotation 9a is the cleanest overall rotation. There are 7 rotations that are about the same in terms of weed pressure and Rotation 4 is the weediest rotation.

Table 77. Wall Rotation Weed Ratings.

Rotation	April 15, 2006		July 15, 2006		October 15, 2006	
	Weed Rating	Weeds Present	Weed Rating	Weeds Present	Weed Rating	Weeds Present
Rotation 1						
Fallow	0.250	Db	0.500	Gft,rt,sg	2.250	Vw,db
W. Wheat	0.375	Rt,ko	0.500	Rt,ko,db	0.000	Pc
Rot Mean	**.312**		**0.500**		**1.125**	
Rotation 2a						
Fallow	0.875	Db,ko, tm	0.500	Gft,sg,ko	2.000	Db,pc,tm,tg
W. Wheat-a	0.125	Ko	0.375	Gft,sg,db	0.125	Pc
Sunflower	1.000	Db,ko,rt	0.500	Gft,ko,lls	0.500	Vw,db,pc
Millet	0.125	Ko,db	1.250	Pw,sg	1.000	Vw,db,tm
W. Wheat-b	0.250	Db, wbw	0.375	Db	0.125	Pw
Corn	2.000	Rt,ko,tg,db	0.000	Rl,ko,tg,db	0.500	Vw,db,pc
Rot Mean	**0.729**		**0.500**		**0.708**	
Rotation 3						
Millet	2.000	Db,tm,lls	0.500	Fm,wg,tg,sg,rt	0.500	Saf,vw,db
W. Wheat	0.500	Db	0.375	Db	0.000	Db
Safflower	0.875	Db,tg,rt	0.500	Jc,sg,ps,gft,tg	0.500	Db,pc
Rot Mean	**1.125**		**0.458**		**0.333**	
Rotation 4						
Millet	2.375	Db,tm,vw	0.875	Sg,ko,pw	0.500	Db,pc
W. Wheat	0.750	Db	1.000	Db,jc	0.375	Db,pc
Rot Mean	**1.562**		**.9375**		**0.437**	
Rotation 5a						
W. Wheat	0.000		0.375	Db	0.000	Db
Corn	0.500	Rt,ko,tg	0.375	Tg	0.000	Db,vw
Sunflower	0.750	Ko,db,tm	0.500	Sg,ps,gft,fm	2.000	Db,vw,tm,pw
S. Barley	0.375	Tg,dan,rt	0.250	Db	1.125	Tm,tg,db,lls
Rot Mean	**0.406**		**0.375**		**0.781**	
Rotation 6a						
W. Wheat-b	0.875	Db,pl	3.250	Db,jc	0.500	Db
Safflower	0.375	Db,tg,rt	0.375	Jc,db,gft	0.250	Pc,db
Field Pea	0.125	Db	0.500	Fm,jc,db,tm,rt,ko	0.500	Saf,db
W. Wheat-a	0.250	Db	1.000	Db,jc	0.500	Tg,db
Rot Mean	**0.406**		**1.281**		**0.437**	
Rotation 9a						
W. Wheat-b	1.875	Db	2.250	Db,jc	0.375	Db
Safflower	0.000		0.625	Tg,sg,lls,an sun,gft,fm,tm	0.500	Db,pc,vw
Hairy Vetch	0.000		0.000		0.500	Saf,db
W. Wheat-a	0.250	Db	1.250	Db,jc	0.500	Db
Rot Mean	**0.531**		**1.031**		**0.468**	
Rotation 10						
Millet	1.125	Db,dan,tm	1.875	Sg,tg,ps,fm,gft	0.500	Db,tg
W. Wheat	0.375	Db,tm,rt,wbw	1.000	Db	0.000	Db
Chickpea	0.250	Db,vw	1.875	Db,mt,tm,rt	0.375	Db
Rot Mean	**0.583**		**1.583**		**0.291**	
Rotation 11						
Millet	0.750	Db,tm	2.250	Sg,tg,byg,ps	2.000	Tm,pc,vw
W. Wheat	0.000		0.000		0.000	
Corn	0.375	Ko,tg,rt	0.125	Gft	0.375	Pc,db,vw
Rot Mean	**0.375**		**0.791**		**0.791**	

Note: Weeds listed above are listed from most to least prevalent.

Note: On the July 15 evaluation date, downy brome and Japanese brome are listed separately because they were easy to differentiate.

Legend: db-downy brome, jc - Japanese chess, vw-volunteer wheat, ko-kochia (ALS & non - ALS strains), pl-prickly lettuce, d - dandelion, bl-blue lettuce, fxt – green or yellow foxtail, rt – Russian thistle, sg – sunkgrass, tg – tumble quelles, byg – barnyard grass, pig - red root pigweed, saf – volunteer safflower, vol millet – volunteer millet, an sun – annual sunflower, pw – pewnly weed f mar – fetid marigold, ps – prostrate spurge, tg – tumble grass. lls – lance-leaf sage, pc – pennycress, wg – witchgrass, pl – prickly lettuce, tm – tansy mustard.

Table 78. Weeds at the Wall Rotation Study and their Characteristics.

Common Name	Growth Form	Life Span	Origin	Season or flowering dates	Reproduction
Downy Brome	Grass	Winter Annual	Europe	Cool	Seeds
Japanese Chess	Grass	Winter Annual	Europe	Cool	Seeds
Tumble grass	Grass	Perennial	Native	Warm	Seeds
ALS Kochia	Forb	Annual	Eurasia	July-October	Seeds
Non-ALS Kochia	Forb	Annual	Eurasia	July-October	Seeds
Russian Thistle	Forb	Annual	Europe	Aug-October	Seeds
Tansy Mustard	Forb	Annual	Native	March-Aug	Seeds
Volunteer Wheat	Grass	Winter Annual		Cool	Seeds
Pennycress	Forb	Ann / W. Ann	Europe	April-June	Seeds
Stink grass	Grass	Annual	Europe	Warm	Seeds
Green Foxtail	Grass	Annual	Eurasia	Warm	Seeds
Yellow Foxtail	Grass	Annual	Europe	Warm	Seeds
Fetid Marigold	Forb	Annual	Native	July-Sept	Seeds
Lance-leaf Sage	Forb	Annual	Native	June-October	Seeds
Prostrate Spurge	Forb	Annual	Native	June-October	Seeds
Common Purslane	Forb	Annual	Eurasia	May-Nov	seed/stem fragments
Dandelion	Forb	Perennial	Eurasia	Apr-October	Seeds
Wiid Buckwheat	Forb	Annual	Europe	June-Sept	Seeds
Prickly Lettuce	Forb	Annual	Europe	July-Sept	Seeds
Mare's Tail	Forb	Annual	Native	June-Sept	Seeds
Barnyard Grass	Grass	Annual	Europe	Warm	Seeds
Common Sunflower	Forb	Annual	Native	July-Sept	Seeds
Witch grass	Grass	Annual	Native	Warm	Seeds
Curlycup gumweed	Forb	Biennial/sl Per	Native	July-October	Seeds
Black Nightshade	Forb	Annual	Native	May-October	Seeds
Blue Lettuce	Forb	Perennial	Native	June-Sept	Rhizomes / seed
Lambsquarters	Forb	Annual	Europe	June-Sept	Seeds
Redroot Pigweed	Forb	Annual	Native	July-October	Seeds
Sand bur	Grass	Ann / sl per.	Native	Warm	Seeds
Buffalo bur	Forb	Annual	Native	May-October	Seeds
Western Salsify	Forb	Biennial/sl Per	Eurasia	May-July	Seeds
Field Bindweed	Forb	Perennial	Eurasia	June-Sept	Rhizomes / seed
Canada Thistle	Forb	Perennial	Eurasia/N. Africa	June-August	Rhizomes / seed

Note: The bolded weeds above are listed from the most to least prevalent in the Wall Rotation Study in the 2006 growing season.

ALS Kochia =Acetolactate Synthase (ALS) resistant Kochia has the ability to produce enzymes to counter the effects of sulfonylurea herbicides.

Legend: sl per = short lived perennial

Information in the above table is from *"Weeds of Nebraska and the Great Plains"* Published by Nebraska Department of Agriculture

SAFFLOWER HERBICIDE TRIAL - 2006

Objective:
1)To evaluate various herbicides for grassy-weed and broad-leaf weed control on safflower.
2)To evaluate the effect of various herbicides on safflower development and yield

Procedures: The previous crop was winter wheat, harvested in the summer of 2005. This experiment was initiated on November 20, 2005. The experiment was arranged in a randomized complete block design with treatments replicated four times. The entire trial was sprayed in early April with 16 oz Roundup Ultra Max + liquid ammonium sulfate to control volunteer winter wheat. Herbicide treatments were sprayed on November 20, 2005 (fall-pre plant), April 10, 2006 (spring-pre plant), and June 9, 2006 (post-emerge). A "control" was incorporated into the experiment to evaluate plots with no herbicides applied. The plots were sprayed with a research 4-wheeler with a 10 foot boom using XR8002 yellow nozzles. All herbicide treatments were applied at 10 gallons per acre rate. The experiment was planted to Finch Safflower on May 4, 2006 with a JD 750 no-till drill. Seeding depth was at ½ to ¾" deep. The seeding rate was 18 pounds per acre. Visual Crop Response Ratings (VCRR) of the safflower crop and weed ratings of the green foxtail and tansy mustard were taken on June 9, 2006 and July 7, 2006. Visual crop response rating and weed ratings were done later (July 7, 2006) on the Harmony GT and Aim treatments. A 5ft. by 35ft. center area of each plot was harvested to determine yield. The experiment was harvested on September 5, 2006 with a Delta Wintersteiger Delta Combine.

Results and Discussion: The fall and spring Spartan applications showed severe leaf burn and some stunting on the safflower crop particularly at the higher rates. All Spartan rates delayed flowering of the safflower. The Spartan was more effective when applied in the fall in terms of grassy weed control. The spring applied Spartan was marginal in terms of tansy mustard control. The Prowl H_2O is primarily a grassy weed herbicide. The Prowl H_2O performed well on the grassy weeds with very minimal effect on yield of the safflower. The Dual II Magnum had very minimal damage to the safflower but only marginal control on the green foxtail and had virtually no control of tansy mustard. Outlook had very minimal damage to the safflower and very good control on the green foxtail. The tansy mustard control using Outlook was not acceptable. The Harmony GT treatment worked excellent on tansy mustard but had no effect on the grassy weeds. Crop injury was not an issue with the Harmony GT. The Atrazine treatment worked well on the tansy mustard but did exhibit some crop injury to the safflower. In a wetter year, crop injury would probably be more apparent. The Aim treatment had minimal effect on the safflower but also did not control green foxtail or tansy mustard. Aim, however; has activity on kochia, redroot pigweed and lambsquarters. All 14 treatments were acceptable in terms of safflower seed color for the birdseed market at harvest time. The growing season was hot and dry and the treatment differences might have been minimized due to the dry weather.

Field Observations: As of June 9, 2006; weeds present at this experimental site included: green foxtail, Russian thistle, stink grass, tansy mustard, prickly lettuce, redroot pigweed, wild buckwheat, annual sunflower and Kochia. As of July 16, 2006, grasshopper feeding was heavy. By this time, flowering of the safflower was completed. Grasshoppers were feeding on the safflower leaves and the previously pollinated yellow florets. The grasshoppers did not feed on the developing seed bowls and safflower seed. The Harmony GT treatment did not control prickly lettuce. The Aim treatment had no grassy weed control. The Spartan treatments did not control annual sunflower. The Prowl H_2O at the 2 pints/A rate did not control annual sunflowers. The Outlook treatment did not control annual sunflower or wild buckwheat.

Conclusion: The Prowl H_2O at the 3 and 3 ½ pints / acre rate did an excellent job of controlling grassy weeds. Safflower crop injury through use of the Prowl H_2O was very minimal. Broadleaf weeds were suppressed also in these treatments. It is very possible that the dry conditions minimized growth and development of the broadleaf weeds. The most cost effective treatment in this trial was the Prowl H_2O @ 2 pints / acre rate.

Table 79. Herbicide treatments and timing.

Timing	Herbicide	Rate	Additives	Application date
	Control			
Fall Pre-plant	Spartan 75df	5 3 oz/A	--	Nov 20, 2005
Fall Pre-plant	Spartan 75 df	8 0 oz/A	--	Nov 20, 2005
Fall Pre-plant	Prowl H2O	2 pints/A	--	Nov 20, 2005
Fall Pre-plant	Prowl H2O	2 ½ pints/A	--	Nov 20, 2005
Fall Pre-plant	Prowl H2O	3 pints/A	--	Nov 20, 2005
Fall Pre-plant	Prowl H2O	3 ½ pints/A	--	Nov 20, 2005
Fall/Spring Pre-plant	Spartan 75 df	3 5 oz/A(fall)	--	Nov 20, 2005
(split)		1 8 oz/A(spg)	--	April 10, 2006
Spring Pre-plant	Dual II Magnum	1.33 pints/A	--	April 10, 2006
Spring Pre-plant	Outlook	19 oz/A	--	April 10, 2006
Spring Pre-plant	Spartan 75df	4 oz/A	--	April 10, 2006
Spring Pre-plant	Atrazine 90df	½ lb/A	32 oz/A crop oil concentrate	April 10, 2006
Spring Post-emerge	Harmony GT	3 oz/A	Penetrate II surfactant @ 0.5% by volume	June 9, 2006
Spring Post-emerge	Aim	.33oz/A	Penetrate II surfactant @ 0 5% by volume	June 9, 2006

Note: Not all herbicides used in this trial are labeled for use in safflower. It is illegal to use herbicides on crops that they are not labeled for.

Precipitation Data on site (November 2005 to October 2006)

November-05	0.22"	February	0.09"	May	1.30"	August	3.15"
December	0.24"	March	0.34"	June	2.16"	September	0.49"
January-06	0.27"	April	1.43"	July	0.60"	October	0.00"

Total precipitation Nov '05 – Oct '06 was 10.29 inches.

Table 80. Herbicide Cost per acre (including application at $3.50/Acre).

Herbicide	Rate	Additives	Cost of Herbicide/A	Yield Lbs Saf/A	Safflower at $ .15 / pound (Value)
Control	--	--	$0.00	249	$37.35
Spartan	5.3 oz/A	--	$17.17	187	28.05
Spartan	8.0 oz/A	--	$24.14	93	13.95
Prowl H2O	2 pints/A	--	$11.18	336	50.40
Prowl H2O	2 ½ pints/A	--	$13.10	305	45.75
Prowl H2O	3 pints/A	--	$15.02	280	42.00
Prowl H2O	3 ½ pints/A	--	$16.94	305	45.75
Spartan	3.5 oz/A(fall) 1.8 oz/A(spr)	--	$20.67	224	33.60
Dual II Magnum	1.33 pints/A	--	$22.63	324	48.60
Outlook	19 oz/A	--	$24.97	317	47.55
Spartan	4 oz/A	--	$13.82	268	40.20
Atrazine 90df	½ lb ai / A	32 oz/A crop oil concentrate	$6.44	243	36.45
Harmony GT	.3 oz/A	Penetrate II surfactant @ 0.5% by volume	$8.23	280	42.00
Aim	.33oz/A	Penetrate II surfactant @ 0.5% by volume	$5.96	205	30.75

Soil Test Data of Safflower Herbicide Trial
Organic Matter = 1.4%
pH = 7.2
Soil Texture = Medium

Table 81. Safflower Herbicide Trial at Wall in 2006.

Treatment	Herbicide	VCRR 0=no crop injury 100=complete kill	Weed control of Green Foxtail (July 7)	Weed Control of Tansy Mustard (July 7)	Days to 50% bloom (Planting to harvest)	Plant Height at harvest (inches)	Test Wt. (lb/bu)	Yield (Lbs/A)
Control	none	0	--	--	72	16	41.2	249
Fall/Spring (Pre-plant) (split)	Spartan @ 3.5 & 1.8 oz/A	53	1	91	75	14	41.2	224
Fall (Pre-plant)	Spartan @ 5.3 oz/A	50	90	90	76	15	42.9	187
Fall (Pre-plant)	Spartan @ 8.0 oz/A	75	99	99	77	14	--	93
Fall (Pre-plant)	Prowl H2O @ 2 pints/A	5	63	60	70	16	41.7	336
Fall (Pre-plant)	Prowl H2O @ 2 ½ pints/A	6	87	70	70	16	41.2	305
Fall (Pre-plant)	Prowl H2O @ 3 pints/A	9	85	81	71	16	41.5	280
Fall (Pre-plant)	Prowl H2O @ 3 ½ pints/A	10	80	90	71	17	41.3	305
Spring (Pre-plant)	Dual II Magnum 1.3 pints/A	6	70	10	71	16	39.9	324
Spring (Pre-plant)	Outlook @ 19 oz/A	6	88	20	71	15	41.5	317
Spring (Pre-plant)	Spartan @ 4 oz/A	50	20	70	73	17	40.3	268
Spring (Pre-plant)	Atrazine 90df @ ½ lb/A	28	1	88	71	15	40.4	243
Spring (Post-emerge)	Harmony GT @ .3 oz/A	*n/a	0	99	71	14	41.6	280
Spring (Post-emerge)	Aim @ .33 oz/A	*n/a	0	0	71	15	40.6	205
	LSD=	5	12	10	1	2	0.3	67
	CV=	19	17	13	1	9	18	18

*n/a = not applicable due to being sprayed later as a (Post-emerge) treatment.